US Army Corps of Engineers
Buffalo District

AD-A278 421

12

Cleveland Harbor
Cuyahoga County, Ohio

Confined Disposal Facility Project

Final Letter Report
(Second Supplement)

March 1994

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Cleveland Harbor, Cuyahoga County, Ohio Confined Disposal Facility Project: Final Letter Report.		5. TYPE OF REPORT & PERIOD COVERED Final
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s)		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, Buffalo 1776 Niagara Street Buffalo, N.Y. 14207-3199		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE 1994
		13. NUMBER OF PAGES 89
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Cleveland Harbor
Confined Disposal Facility
Dredged Material Disposal

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This technical report updates earlier reports that recommended the dikes be raised by seven feet at the existing Federal Confined Disposal Facility (CDF) at Site 14 and the construction of a new CDF at Site 10, north of Burke Lakefront Airport. During planning and design of the new site, water quality, water circulation, and other concerns were raised regarding the adjacent embayment caused by the construction of the CDF. A decision was made in February 1991 to terminate the work at the Burke East Site. This report describes the sites that were considered and evaluated, resubmits a modified Site 10 disposal area adjacent to Burke Airport, and presents an economic and environmental evaluation of the site.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Supplement Number Two to:

CLEVELAND HARBOR, OHIO
CONFINED DISPOSAL PROJECT
LETTER REPORT

Dated January 1987

U.S. Army Corps of Engineers
Buffalo District
1776 Niagara Street
Buffalo, New York 14207

1994

Supplement Number Two to
Cleveland Confined Disposal Report
Letter Report
Dated January 1987

TABLE OF CONTENTS

APPENDICES

Second Supplement to Cleveland, Ohio Confined Disposal Project Letter Report

1. GENERAL

Cleveland Harbor, Ohio is located at the mouth of the Cuyahoga River on the south shore of Lake Erie. By water, the port is approximately 176 statute miles west of Buffalo Harbor, New York and 96 miles east of Toledo Harbor, Ohio. Cleveland is an important Great Lakes port city. The population in the Cleveland and Cuyahoga County vicinity is about 1,445,000. Because of its location and transportation facilities, Cleveland has become an important local, State, Regional, National, and World center of industry and commerce. Commodities which move through the Harbor include: limestone, iron ore, cement, sand, gravel, salt, oil, grain, and general cargo. Land use in the Cleveland Harbor area is generally a mix of industrial, commercial, transportation, recreational, and some residential. The general vicinity of Cleveland Harbor provides habitat for a variety of forage and game fish and some wildlife.

Federal navigation channels in Cleveland include those in the Outer Harbor, the Old River Channel, and the Cuyahoga River Channel. Most sediments dredged from these channels are classified as polluted and not suitable for open-lake discharge. Confined disposal facilities (CDF) have been developed and utilized within the harbor area for disposal of dredged material over the last few decades. The CDF currently being utilized (CDF 14) is approaching fill capacity. Continued dredged material discharge procedures need to be identified and considered.

The U.S. Army Corps of Engineers, in conjunction with Federal, State, and local interests, has investigated problems and needs pertaining to maintenance of Federal navigation facilities and annual dredging and discharge of approximately 300,000 cubic yards of polluted sediments, not suitable for open lake discharge, dredged from Federal navigation channels at Cleveland Harbor. The study was conducted in accordance with present Federal legislation, guidelines and regulations. In addition to the No Action (Without Project Conditions) alternative, an array of alternate measures and/or plans were evaluated for engineering and economic feasibility, social and environmental acceptability; and their contributions towards accomplishing project planning objectives.

This Report

This report describes the events that have occurred since the Cleveland Harbor, Ohio Confined Disposal Project Letter Report (November 1986, revised 26 January 1987) was approved by North Central Division on 25 February 1987. The earlier report recommended that the dikes be raised by seven feet at the existing Federal Confined Disposal Facility (CDF) at Site 14 and

the construction of a new CDF at Site 10, north of Burke Lakefront Airport. After a local cooperator could not be found for the utility relocations at Site 10, Buffalo District met with local interests to locate a new site. A new site was located and the First Supplement to the Letter Report (September 1989) was prepared. It was subsequently approved by NCD on 27 August 1990. The September 1989 report recommended that the dikes be raised at Site 14 and the construction of a new CDF at the Burke Airport East 15-year site. Reference Figure 1.

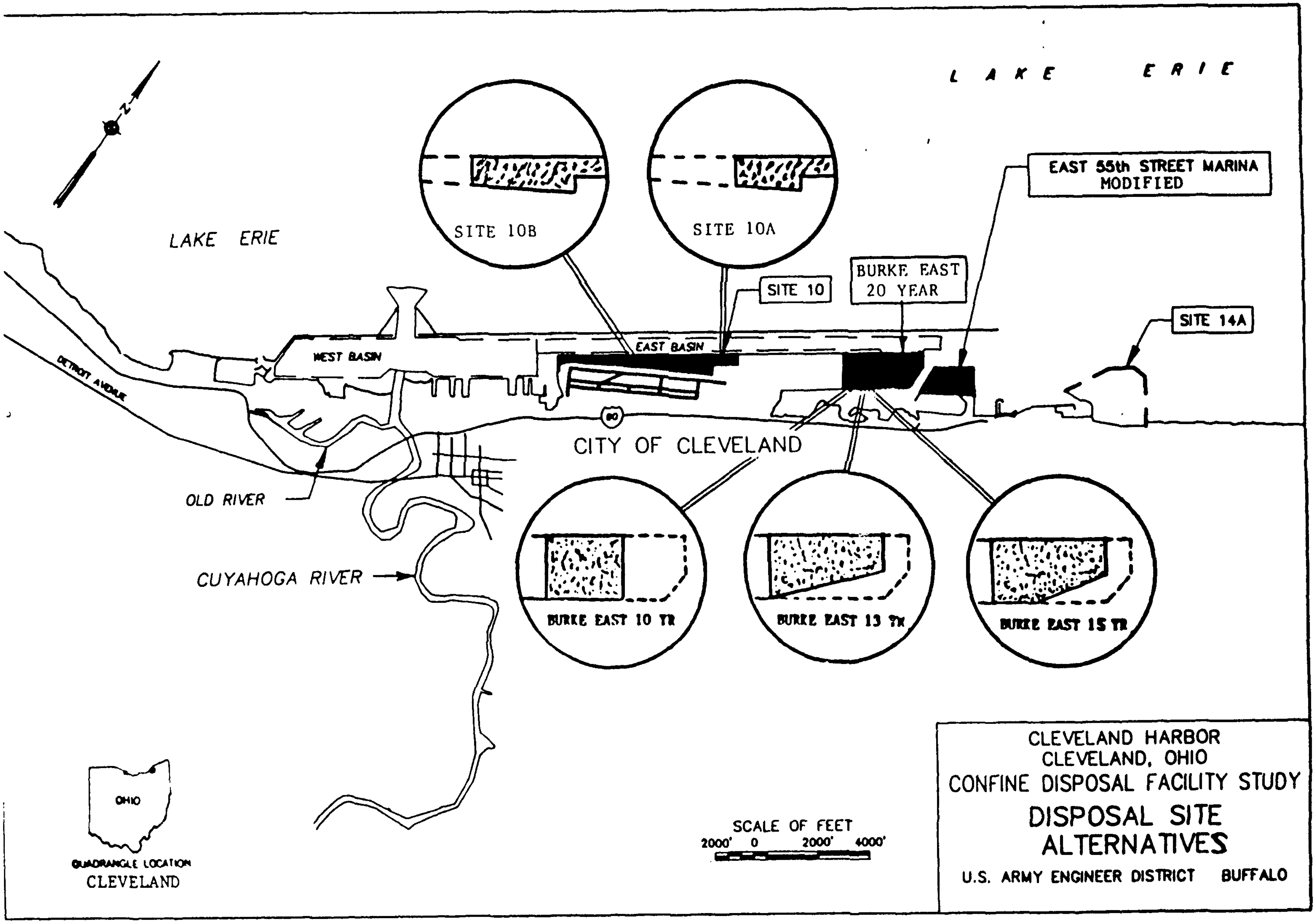
During continued planning and coordination and design of the CDF at the Burke Airport East site water quality, water circulation, and other concerns were raised regarding the adjacent embayment caused by the construction of the CDF. Resolution of the water quality concerns would have required extensive testing and physical modeling. This testing and modeling would have required substantial funding and time with no certainty that the final results would resolve the issues raised on the impacts the CDF would have on water quality in the embayment. The water quality testing and modeling would have caused the schedule for construction of a new CDF to slip and construction would not be completed prior to the filling of the currently utilized Dike 14 even if the testing indicated no adverse impacts. This slippage in schedule would have impacted dredging and harbor operations and a decision was made in February 1991 to terminate the work on the Burke East site.

After the study of the Burke East site was terminated, Buffalo District met with local interests to locate a new disposal site. This report describes the sites that were considered and evaluated, resubmits a modified Site 10 disposal area adjacent to Burke Airport for approval, and presents an economic and environmental evaluation of the site. Raising the dikes at Site 14 remains an integral portion of the overall solution to contain the dredged sediments in the near future.

2. PROJECT AUTHORITY AND LOCAL COOPERATION

a. Project Authority

The existing Federal navigation project at Cleveland, Ohio was authorized by the Rivers and Harbors Acts of 1875, 1886, 1888, 1899, 1902, 1907 and 1910. The 1937 Rivers and Harbors Act made the maintenance of the channels in the Cuyahoga and Old Rivers to a depth of 21 feet a Federal responsibility. All subsequent legislation has made maintenance of all channels in Cleveland Harbor a Federal responsibility. Since the new confined disposal facility is to be constructed under operations and maintenance authority the original project authority applies, which are the River and Harbors Acts of 1946, 1958, 1960 and 1962.



LAKE ERIE
LAKE ERIE
N
SITE 10B
SITE 10A
EAST 55th STREET MARINA MODIFIED
SITE 10
BURKE EAST 20 YEAR
SITE 14A
WEST BASIN
EAST BASIN
DETROIT AVENUE
90
CITY OF CLEVELAND
OLD RIVER
CUYAHOGA RIVER
BURKE EAST 10 YR
BURKE EAST 13 YR
BURKE EAST 15 YR
OHIO
QUADRANGLE LOCATION
CLEVELAND
SCALE OF FEET
2000' 0 2000' 4000'
CLEVELAND HARBOR
CLEVELAND, OHIO
CONFINE DISPOSAL FACILITY STUDY
DISPOSAL SITE ALTERNATIVES
U.S. ARMY ENGINEER DISTRICT BUFFALO

FIGURE 1

b. Local Cooperation

The construction of the new CDF is required for the continued maintenance of the existing project and therefore will be accordance with the original project authorizing documents. The construction of the CDF is not included under the cost sharing requirements of P.L. 99-662 since the Act does not apply to previously existing projects. The city of Cleveland, as the local sponsor, would be required to provide the following assurances:

a. Furnish without cost to the United States all lands, easements, and rights-of-way necessary for construction, operation, and subsequent maintenance, when and as required;

b. Accomplish without cost to the United States all alterations and relocations of transportation systems, storm drains, sewer outfalls, utilities,and other relocations and alterations made necessary by the project;

c. Hold and save the United States free from damages due to construction, operation, and maintenance of the facility; and

d. Maintain the facility after completion of its use for disposal purposes in a manner satisfactory to the Secretary of the Army.

3. ALTERNATE DISPOSAL PLANS

The 1986 Letter Report, which recommended raising the walls of the existing Dike 14 and constructing a new CDF at Site 10, considered 16 alternative plans in connection with seven sites. The 1989 supplemental report considered five alternative plans in connection with three sites. Reference Figure 1.

During a February 1991 meeting between the City of Cleveland and the Corps of Engineers Buffalo District, the City proposed a modification to Site 10 which was proposed in the January 1987 Letter Report. The Site 10 CDF proposed in 1987 had an area of approximately 86 acres with a usable capacity of 4,732,000 cubic yards. The construction of the Site 10 CDF would have required the extension of nine sewer outfalls. The current site modification proposed is referred to as Site 10B. This is a smaller site, has fewer utilities to relocate, and is shown in Figure 2.

Site 10B has an area of approximately 68 acres with a usable volume of 3,840,000 cubic yards. It provides approximately 15 years of capacity for consolidated dredged material at a rate of 300,000 cubic yards per year with a consolidation rate of 0.78. The CDF entails construction of a 5050 foot long rubblemound dike with a top elevation of approximately +14 feet LWD placed in water with

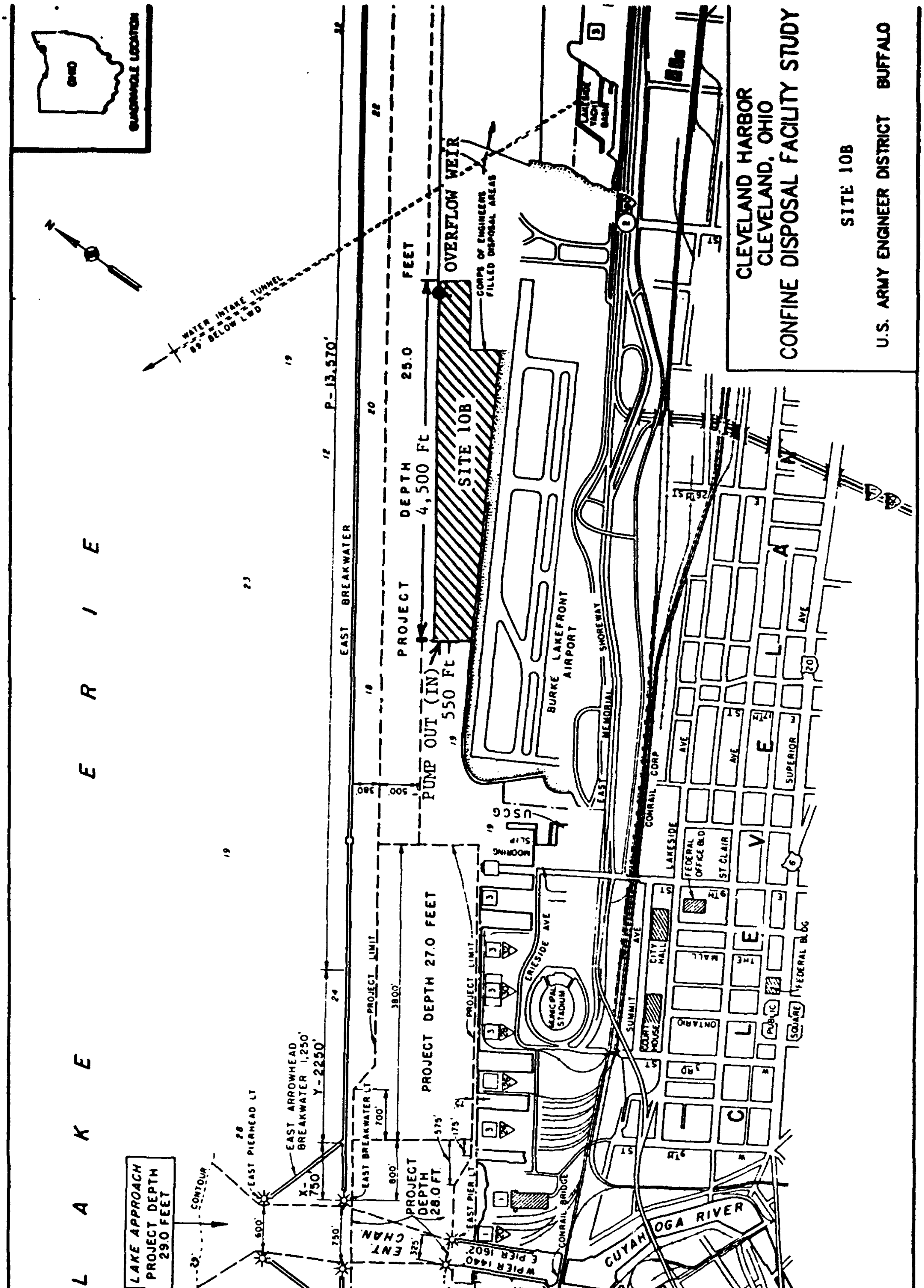

CLEVELAND HARBOR
CLEVELAND, OHIO
CONFINE DISPOSAL FACILITY STUDY
SITE 10B
U.S. ARMY ENGINEER DISTRICT BUFFALO
OHIO
QUADRANGLE LOCATION
LAKE ERIE
WATER INTAKE TUNNEL
EAST BREAKWATER
P-13,570'
PROJECT DEPTH 25.0 FEET
4,500 Ft
SITE 10B
OVERFLOW WEIR
PUMP OUT (IN)
550 Ft
CORPS OF ENGINEERS FILLED DISPOSAL AREAS
BURKE LAKEFRONT AIRPORT
EAST MEMORIAL SHOREWAY
USCG
MOORING SLIP
PROJECT DEPTH 27.0 FEET
PROJECT LIMIT
3800'
LAKE APPROACH
PROJECT DEPTH
29.0 FEET
CONTOUR
EAST PIERHEAD LT
EAST ARROWHEAD BREAKWATER 1,250'
Y-2250'
X-750'
EAST BREAKWATER LT
PROJECT DEPTH 28.0 FT
EAST PIER LT
ENT. CHAN.
W PIER 1440
E PIER 1602
CONRAIL BRIDGE
CUYAHOGA RIVER
MUNICIPAL STADIUM
ERIESIDE AVE
SUMMIT AVE
CITY HALL
COURT HOUSE
FEDERAL OFFICE BLDG
FEDERAL BLDG
PUBLIC SQUARE
LAKESIDE AVE
ST CLAIR AVE
SUPERIOR AVE
ONTARIO
THE MALL
CONRAIL CORP
CLEVELAND

FIGURE 2

a depth averaging -20 feet LWD. The construction of the CDF would require the extension of six sewer outfalls through the new CDF Reference Figure 4. The estimated construction cost is $32,880,000 including $3,980,008 for the extension of the storm sewer outfalls. The storage cost per cubic yard of consolidated dredge material is $6.68. Figure 3 presents the cross section of the proposed stone dike. The net annual benefits would be $3,484,700 with a benefit-to-cost ratio of 1.78.

A summary of the alternatives presented in the 1989 supplemental report plus Site 10B is presented in Table 1. A detailed description of the alternatives is presented in the 1989 supplemental report.

Table 1
Summary of Supplemental Plans and Sites
for a Confined Disposal Facility for Cleveland Harbor

Site	Area (Acres)	Volume (Yds^3)	Years(1)	Costs (Aug 1991)	$\$/yd^3$ of Consolidated Material
Site 10B	68	3,840,000	15	$32,880,000	6.68
Modified Site 10	36	2,071,000	8.9	18,200,000	7.19
Burke East(2) (10-year)	40	2,340,000	10	21,700,000	7.23
Burke East(2) (13-year)	53	3,100,000	13	28,500,000	7.17
Burke East(2) (15-year)	60	3,510,000	15	29,300,000	6.51
Burke East(2) (20-year)	81	4,751,000	20	33,100,000	5.43
ODNR E. 55th Street	41	2,381,000	10	27,000,000	8.85

(1) Disposal rate of 300,000 cubic years and a 22 percent consolidation factor used based upon current conditions at Cleveland Dike 14.

(2) All of the Burke East sites would be subject to the water quality and circulation concerns raised during the detailed design of the Burke East 15-Year site and would therefore be unacceptable.

4. PROPOSED DISPOSAL PLAN

As shown in Table 1 the cost per cubic yard of dredged material is the least for the Burke East (20-year) site followed by the Burke East (15-year) site. The 20-year site was found to be unacceptable by the Ohio Department of Natural Resources during the preparation of the 1989 supplemental report and would also be subject to the same water quality, water circulation, and

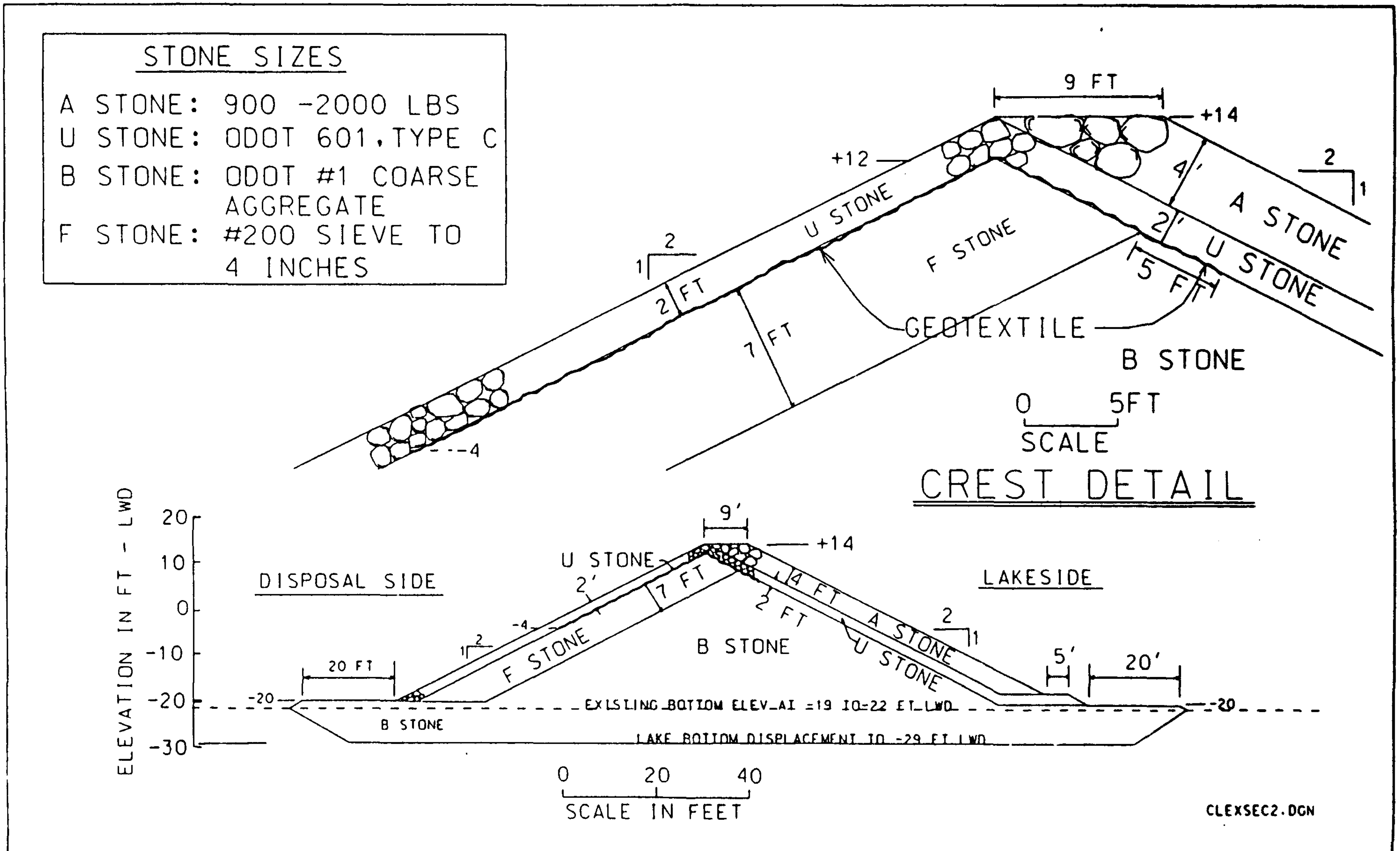


FIGURE 3 TYPICAL CROSS-SECTION

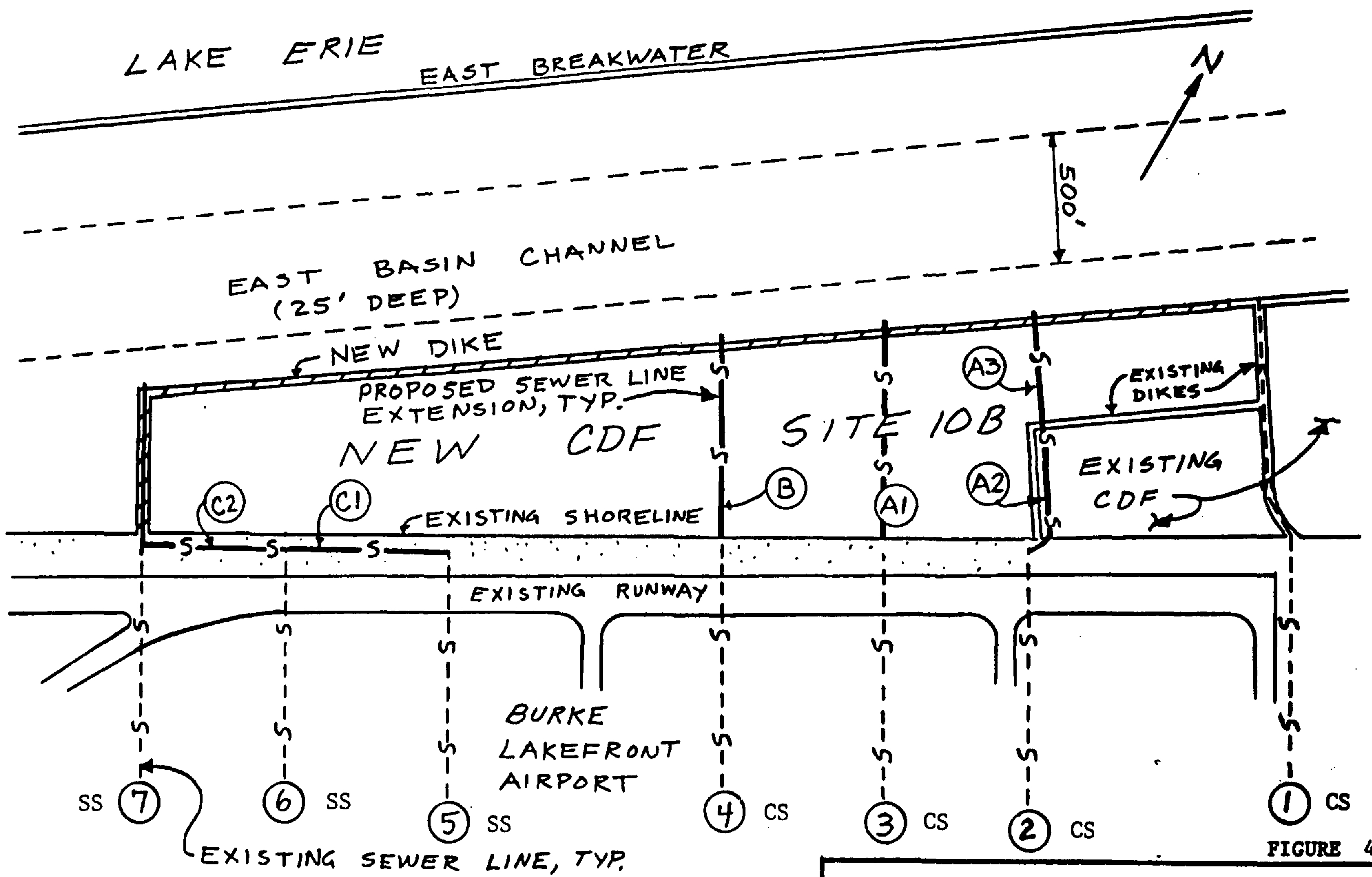


FIGURE 4

SCALE 1" = 550'

CS - combined sewer
SS - storm sewer

SITE 10B CDF
CLEVELAND, OHIO

PROPOSED SEWER LINE EXTENSIONS
PLAN

US ARMY CORPS OF ENGINEERS, BUFFALO DISTRICT

other concerns as the Burke East (15-year) site. The Burke East (15-year) site was the site proposed in the 1989 supplemental report but is no longer considered a feasible solution due to the water quality, water circulation, and other concerns noted previously.

The selected plan is Site 10B since it provides the lowest cost per cubic yard ($6.68) solution to the disposal of dredged material that is supported by the City of Cleveland. The City has agreed to act as the local cooperator for the Site 10B CDF by letter dated August 9, 1991. The project is considered to be reasonably environmentally acceptable.

5. CONSTRUCTION COST ESTIMATE

The estimated first cost of construction of the CDF at Site 10B is $32,880,000 including $3,980,000 for the extension of six storm sewer outfalls. A detailed breakdown of the construction cost is shown in Table 2.

Table 2
Total First Cost
(August 1991 Price Levels)
Cleveland Site 10B CDF

Dike Construction

Item	Estimated Quantity	Unit	Unit Price	Estimated Amount	
A2 Stone	86,000	Ton	$35.50	$ 3,053,000	
U2 Stone	54,200	Ton	34.10	1,848,220	
B Stone	1,050,000	Ton	12.10	12,705,000	
F Stone	113,000	Ton	13.00	1,469,000	
Impervious Fill	13,500	CY	13.00	182,250	
Geotextile	24,200	SY	2.15	52,030	
Mob. & Demob.		LS		440,000	
Total Contractor's Earnings				$19,749,500	
Contingencies (25%)				4,950,000	
Total Contractor's Earnings Plus Contingencies				24,700,000	
Engineering & Design				1,730,000	
Construction Management				2,470,000	
					28,900,000

Table 2 (Cont'd)
Total First Cost
(August 1991 Price Levels)
Cleveland Site 10B CDF

Storm Sewer Extensions

Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
36" Dia. CMP	-	LS	-	218,000
65" x 40" CMP	-	LS	-	262,000
72" Dia. CMP	-	LS	-	463,000
10'3" x 6'9" PIPE ARCH	-	LS	-	610,000
11'5" x 7'3" PIPE ARCH	-	LS	-	578,000
12'6" x 7'11" PIPE ARCH	-	LS	-	534,000
Mob. & Demob.	-	LS	-	60,000
Total Contractor's Earnings				$ 2,725,000
Contingencies (25%)				675,000
Total Contractor's Earnings Plus Contingencies				3,400,000
Engineering & Design				238,000
Construction Management				342,000
Total First Cost of Construction				3,980,000

Total Project Cost $32,880,000

The cost of the construction of the CDF is to be funded with 100% Federal funds and the cost of the sewer extensions is to be funded with 100% non-Federal funds. The local sponsor has indicated an interest in the Buffalo District providing engineering services on a cost reimbursable basis for the engineering and design associated with the extension of the storm sewer outfalls.

6. SUMMARY OF ECONOMIC EVALUATION

The commercial shippers utilizing Cleveland Harbor require adequate shipping channel depths to maintain economically viable operations. Without a disposal facility for the polluted dredged sediments, shoaling of the Federal channels would occur which would decrease the draft that vessels could utilize to enter the harbor area and access the docks. This decrease in draft would result in a decreased tonnage of bulk commodities being transported by each vessel trip. A greater number of vessel trips would be necessary to deliver the same quantity of bulk commodities to the recipient of the commodity. This would increase the costs of the waterborne transportation and ultimately could result in a traffic shift to other Great Lakes harbors, or a resultant shift to other modes of transportation such as rail.

The construction of the Site 10B CDF was evaluated for economic efficiency by comparing the cost of constructing the CDF plus the annual maintenance cost to the increase in transportation costs if maintenance dredging was discontinued. The project economics were evaluated over a 50 year evaluation period beginning in 1997.

The "without project" condition assumed that no maintenance dredging would occur after 1997 due to the lack of a disposal facility. The transportation costs were calculated for the affected shippers based upon the annual shoaling which would affect the Federal channel.

The average annual transportation costs under the "with project" condition were calculated assuming dredging from project years 1 to 15 to coincide with the capacity of the Site 10B CDF. Under the "with project" condition it is assumed that dredging will be discontinued from project year 16 to project year 50. This assumption is utilized only for the economic evaluation and is not based upon future dredging expectations.

The average annual project benefits to the project have been developed as the difference between the transportation costs for the "without project" condition and the "with project" condition. The average annual benefits for the project based on transportation costs avoided are $7,896,500.

The average annual costs of the project were developed based upon the construction cost of the CDF at Site 10B, maintenance costs for the CDF and annual maintenance dredging costs. The construction cost of the CDF included costs for planning, engineering and design, construction management, and interest during construction. The annual maintenance dredging costs are included as a project cost since the benefits attributable to the construction of the new CDF will not be realized unless the Federal channels are dredged. The average annual costs for the project were calculated to be $4,411,800.

The net benefits for the project are defined as the difference between the average annual benefits and the average annual costs and total $3,484,700. The benefit to cost ratio for the project has been calculated as 1.78.

7. ENVIRONMENTAL IMPACTS

A Notice of Intent to prepare a Draft Environmental Impact Statement (DEIS) was prepared by the Buffalo District and published in the Federal Register on August 29, 1985. An EIS was prepared for this project for the following reasons: (1) an EIS is normally prepared for a project of this scope; (2) public and agency concerns; and (3) potential impacts relative to Cleveland Harbor and the surrounding community and environment. The EIS discusses, in considerable detail, project: problems and needs, alternative considerations and recommendations, the environmental setting, environmental effects, and public involvement.

The notice of availability for the Draft EIS for Cleveland Harbor, Ohio was published in the Federal Register on January 29, 1993. Comments received regarding this Draft EIS and responses have been added to the Preliminary Final EIS presented in the second volume of this report. Notice will be made and the FEIS will be coordinated for a 30-day review period. If the proposed project is approved, a Record of Decision will be signed and coordinated. Subsequent preparation of final plans and specifications, and construction would follow.

Table 3 consists of a summary page with comparative impacts of the No Action Plan and the Site 10B and Burke East Sites (both 15-year CDFs) and follows up with impact discussions which briefly describe the anticipated environmental impacts (by parameter) of the most feasible CDF plans for Cleveland Harbor, Ohio. Impacts for the Burke East Site (10-year, 13-year, and 20-year) CDF plans would be proportionately similar to those for the Burke East Site (15-year) CDF plan. Impacts for the Site 10A (9-year) CDF plan would be proportionately similar to those for the Site 10B (15-year) CDF plan.

Summary Table 4, which follows, indicates the relationship of plans considered in detail to Federal and State Environmental Protection Statutes, Executive Orders, and Memoranda.

The U.S. Fish and Wildlife Service has completed their Coordination Act Report pertaining to the proposed CDF site. A copy of the report and the Corps' responses are included in Letter Report Appendix C.

8. PROJECT DESIGN AND CONSTRUCTION SCHEDULE

The schedule outlined below shows the key milestones that must be met (pending planning and environmental approval) to accomplish the construction of the new CDF within the time frame necessary to ensure completion prior to the filling of the raised Dike 14.

Design Analysis to NCD	October 1994
NCD Approval of Design Analysis	November 1994
Completion of Plans and Specifications	March 1995
Execute LCA	April 1995
Advertise Construction Contract	May 1995
Award Construction Contract	June 1995
Begin Construction	July 1995
Construction Complete	June 1998

Summary Table 3 Comparative Impacts of No Action and Detailed Plans

Evaluation Parameters	No Action (Without Project Conditions)	Site 10B 15-Year CDF	Burke East Site 15-Year CDF
Economics B/C			
Federal Share		28,900,000	29,300,000
Non-Federal Share		3,980,000	0
Total		32,880,000	29,300,000
Benefits (Av. An)	N/A	7,896,500	
Costs (Av. An)		4,411,800	
B/C		1.78	NFC
Net Benefits (Av. An)		3,484,700	
Natural Environment Resources			
Air Quality	ST: Not Significant LT: Not Significant	ST: Moderate Adverse LT: Minor Adverse	ST: Moderate Adverse LT: Minor Adverse
Water Quality	ST: Not Significant LT: Not Significant	ST: Moderate Adverse LT: Minor Adverse	ST: Moderate Adverse LT: Minor Adverse
Sediment Quality	ST: Not Significant LT: Not Significant	ST: Moderate Adverse LT: Moderate Beneficial	ST: Moderate Adverse LT: Moderate Beneficial
Benthos/Plankton	ST: Not Significant LT: Minor Adverse	ST: Moderate Adverse LT: Major Adverse Minor Beneficial	ST: Moderate Adverse LT: Major Adverse Minor Beneficial
Fisheries	ST: Not Significant LT: Moderate Beneficial	ST: Moderate Adverse LT: Major Adverse Minor Beneficial	ST: Moderate Adverse LT: Major Adverse Minor Beneficial
Vegetation	ST: Not Significant LT: Not Significant	ST: Minor Adverse LT: Moderate Beneficial	ST: Minor Adverse LT: Moderate Beneficial
Wetlands	ST: Not Significant LT: Not Significant	ST: Not Significant LT: Not Significant	ST: Not Significant LT: Not Significant
Wildlife	ST: Not Significant LT: Not Significant	ST: Moderate Adverse LT: Moderate Adverse Moderate Beneficial	ST: Moderate Adverse LT: Moderate Adverse Moderate Beneficial
Threatened & Endangered Species	ST: Not Significant ST: Not Significant	ST: Not Significant ST: Not Significant	ST: Not Significant ST: Not Significant
Human Environment Man Made Resources			
Community and Regional Growth	ST: Moderate Adverse LT: Major Adverse	ST: Moderate Beneficial LT: Major Beneficial	ST: Minor Beneficial LT: Moderate Beneficial
Displacement of People	ST: Minor Adverse LT: Moderate Adverse	ST: Not Significant LT: Not Significant	ST: Not Significant LT: Not Significant
Displacement of Farms	ST: Not Significant LT: Not Significant	ST: Not Significant LT: Not Significant	ST: Not Significant LT: Not Significant
Business/Industry Employment/Income	ST: Moderate Adverse LT: Major Adverse	ST: Moderate Beneficial LT: Major Beneficial	ST: Moderate Beneficial LT: Major Beneficial
Public Facilities and Services	ST: Minor Adverse LT: Moderate Adverse	ST: Moderate Adverse LT: Moderate Beneficial	ST: Minor Adverse LT: Moderate Beneficial
Recreational Resources	ST: Minor Adverse LT: Minor Adverse	ST: Minor Adverse LT: Minor Beneficial	ST: Minor Adverse LT: Minor Beneficial
Property Values and Tax Revenues	ST: Minor Adverse LT: Moderate Adverse	ST: Minor Adverse LT: Minor Beneficial	ST: Minor Adverse LT: Minor Beneficial
Noise and Aesthetics	ST: Not Significant LT: Minor Adverse	ST: Minor Adverse LT: Not Significant	ST: Moderate Adverse LT: Moderate Adverse
Community Cohesion	ST: Moderate Adverse LT: Major Adverse	ST: Minor Adverse LT: Moderate Beneficial	ST: Moderate Adverse LT: Minor Beneficial
Cultural Resources	ST: Not Significant LT: Minor Adverse	ST: Not Significant LT: Not Significant	ST: Not Significant LT: Not Significant

Key:

ST: Short Term
LT: Long Term
N/A: Not Applicable
(AA): Average Annual
NFC: Not Final Calculated

Range:

Major Beneficial
Moderate Beneficial
Minor Beneficial
Not Significant
Minor Adverse
Moderate Adverse
Major Adverse

Note

*Narrative provided in "SECTION 4 - ENVIRONMENTAL EFFECTS" of the ENVIRONMENTAL IMPACT STATEMENT.

Table 3 - Comparative Impacts of Detailed Plans

Evaluation Parameter	No Action (Without Project Conditions)	Site 10B (15-Year) Confined Disposal Facility	Burke East Site (15-Year) Confined Disposal Facility
ECONOMICS B/C			
Federal Costs	N/A	28,900,000	29,300,000
Non-Federal Costs		3,980,000	0
Total Cost		32,880,000	29,300,000
Benefits (AA)		7,896,500	
Costs (AA)		4,411,800	NFC
B/C (AA)		1.78	
Net Benefits (AA)		3,484,700	
NATURAL ENVIRONMENT (RESOURCES)			
Air Quality	ST: Not Significant LT: Not Significant	ST: Moderate Adverse LT: Minor Adverse . Some localized temporary air quality degradation due to fuel combustion, particulate emissions and fuel odor from equipment operation during dredging and CDF construction . Some temporary localized odor may occur from dredged material during annual dredging and deposition into the CDF.	ST: Moderate Adverse LT: Minor Adverse . Similar short-term adverse impacts on air quality as for Site 10B (15-year) CDF.
Water Quality	ST: Not Significant LT: Not Significant	ST: Moderate Adverse LT: Minor Adverse . Localized temporary increased water turbidity & resuspension of sediment during dredging and construction of the stone CDF dike. . Some filtration leaching of dredged material effluent through the stone dike. Effluent leaching would probably decrease eventually as silt, sediment, and bacterial slime contributed toward plugging up voids among stones within the CDF dike. . Some minor possible fuel, oil or grease spillage into the water by normal operation of equipment during dredging and construction of the project, and during dredged material disposal. . Installation of the CDF stone dike would contribute toward some localized alteration of current patterns in the general vicinity of the project site. . Some possible localized impact on water quality if zebra mussels colonize submerged dike stone (i.e., increased water clarity).	ST: Moderate Adverse LT: Minor Adverse . Similar probable effects on water quality as described for the Site 10B (15-Year) CDF alternative plan.

Key to Symbols

(AA) : Average Annual
ST : Short Term
LT : Long Term
NFC : Not Final Calculated

Table 3 - Comparative Impacts of Detailed Plans (Cont'd)

Evaluation Parameter	No Action (Without Project Conditions)	Site 10B (15-Year) Confined Disposal Facility	Burke East Site (15-Year) Confined Disposal Facility
Sediment Quality	ST: Not Significant LT: Not Significant	ST: Moderate Adverse LT: Moderate Beneficial . Temporary short-term localized disruption and resuspension of bottom silts, sediments and detritus into the water column by construction activity at the time the dike is being built, as well as during annual dredging and discharge of dredged material into the completed CDF. . Temporary improvement in substrate quality in navigation channels by dredging and removal of polluted sediments and subsequent deposition of such material into the CDF. . Annually dredged navigation channels would tend to trap polluted sediments from upstream areas, thereby reducing potential for transport of such material further lakeward.	ST: Moderate Adverse LT: Moderate Beneficial . Similar sediment impacts as described for the Site 10B (15-Year) alternative plan.
Benthos/Plankton	ST: Not Significant LT: Minor Adverse . Navigation channels would eventually fill-in with sediment; deep benthic habitat would be lost. Also, there will be a loss of water column for phytoplankton and zooplankton. Benthic organisms would soon recolonize substrate near the top of filled-in channels.	ST: Moderately Adverse LT: (1) Major Adverse (2) Minor Beneficial . Long-term displacement of planktonic organisms from the water column that would be filled by dike stone. . Disruption of benthic and planktonic organisms and associated habitat (substrate/water column) in the channels & CDF during annual dredging and discharge of dredged material. . Eventual loss of all aquatic habitat for benthic and planktonic organisms within the 68-acre CDF site. . Dike stone placed on the lake bottom would cover about 25 acres of benthic organism habitat and crush a number of existing benthic invertebrates. . Stone placed below the waterline would provide about 9 acres of stable, long-term substrate for benthic invertebrate colonization long the lakeward facing slope of the dike. Submerged stone along the inside slope of the dike would also provide substrate for such organism colonization, but on a short-term basis, until the CDF became filled-in with dredged material above the waterline.	ST: Moderate Adverse LT: (1) Major Adverse (2) Minor Beneficial . Similar impacts as described for the CDF Site 10B (15-Year) alternative plan, except that the lake bottom substrate upon which dike stone would be placed would cover about 19.5 acres of benthic organism habitat and associated invertebrates. . Submerged stone placed along the lakeward facing slope of the rubblemound dike would provide about 6.5 acres of new substrate habitat surface area for benthic organism recolonization.

Table 3 · Comparative Impacts of Detailed Plans (Cont'd)

Evaluation Parameter	No Action (Without Project Conditions)	Site 10B (15-Year) Confined Disposal Facility	Burke East Site (15-Year) Confined Disposal Facility
Fisheries	ST: Not Significant LT: Moderate Beneficial No annual disruption to fish habitat and associated fish since CDF construction would not occur. Possibly some improvement in quality fish habitat in the long-run if sources of pollution were eventually rectified.	ST: Moderate Adverse LT: (1) Major Adverse (2) Minor Beneficial . All deep water aquatic habitat within the 68-acre lake area of the CDF site would eventually be filled-in with dredged material and therefore, eliminated from further utilization by fish as spawning and/or feeding habitat. The submerged outside portion of the CDF dike exposed to the lake proper, would provide about 9 acres of irregular long-term stone substrate as habitat for fish. . Water turbidity during dredging and CDF construction may temporarily aggravate fish gill systems. . Agitation of the water column during dike stone placement and during annual dredging and discharge of dredged material would temporarily cause many fish to avoid the immediate zone of project activity, until work ceased at the site. . If feasible, consideration will be given to limited live capture and removed of some of the fish from the CDF, with subsequent release of such fish into lake water outside the CDF. Fish not captured, would unavoidably be destroyed by dredged material deposition and eventual elimination of aquatic habitat at the site	ST: Moderate Adverse LT: (1) Major Adverse (2) Minor Beneficial . All fish habitat within the 60-acre lake area of the CDF would eventually be destroyed by filling with dredged material. The submerged outside portion of the CDF dike exposed to the lake proper, would provide about 6.5 acres of irregular, long-term stone substrate as habitat for fish. . Similar turbidity, water column, and benthic fishery impacts as indicated for Site 10B (15-Year).
Vegetation	ST: Not Significant LT: Not Significant	ST: Minor Adverse LT: Moderate Beneficial . Loss of some aquatic submergent plants - predominantly filamentous algae. Also, some minor loss or disruption on scattered growth of herbaceous and woody vegetation along the terrestrial shoreline bank in the project zone. . Natural establishment of aquatic vegetation would likely temporarily occur over the CDF site, as water becomes shallower, and dredged material accumulations temporarily create damp mudflats. . Submerged stone on outside dike slopes of the CDF would provide long-term hard substrate for filamentous algae attachment. . Eventual conversion of the deep water site to about 68 acres of terrestrial land, that, if left undeveloped, would become invaded with native grasses, forbs, shrubs, and trees.	ST: Minor Adverse LT: Moderate Beneficial . Loss of some aquatic submergent plants - predominantly filamentous algae. . Submerged stone of outside dike slopes of the CDF would provide long-term substrate for some filamentous algae attachment. . Eventual conversion of the deep water site to about 60 acres of terrestrial land that would become established with vegetation as described for CDF Site 10B (15-year).

Table 3 - Comparative Impacts of Detailed Plans (Cont'd)

Evaluation Parameter	No Action (Without Project Conditions)	Site 10B (15-Year) Confined Disposal Facility	Burke East Site (15-Year) Confined Disposal Facility
Wetlands	ST: Not Significant LT: Not Significant	ST: Not Significant LT: Not Significant . Construction of Site 10B (15-Year) would have no significant adverse impact on small remaining scattered pockets of wetlands in nearby existing CDF Site 12. There are no other nearby wetlands in the general project locale.	ST: Not Significant LT: Not Significant . Construction of the Burke East (15-Year) CDF would have no significant adverse impac on small, scattered pockets of wetlands in nearby existing CDF Site 12. There are no other nearby wetlands in the general project locale.
Wildlife	ST: Not Significant LT: Not Significant	ST: Moderate Adverse LT: (1) Moderate Adverse (2) Moderate Beneficial . Similar short & long term impacts on wildlife as described for the Burke East (15-Year) CDF, except that: . About 68 acres of open water area would eventually be converted from habitat used by aquatic birds, to terrestrial habitat for upland wildlife; . Dike stone above the waterline would provide about 5,050 linear feet of stable long-term resting/loafing habitat for gulls, terns and some other bird species. . The calmer pooled area as well as the poorly drained dredged material (exposed above the waterline) in the CDF, would likely attract aquatic birds such as sea-gulls, waterfowl, and shorebirds, until the site becomes better drained and more vegetated. Eventually, terrestrial veget-ation establishment would provide habitat similar to that provided by the existing nearby CDF Site for use by upland bird species. Attraction to the site by birds may be a potential temporary nuisance or hazard to aircraft utilizing the Burke Lakefront airport.	ST: Moderate Adverse LT: (1) Moderate Adverse (2) Moderate Beneficial . Temporary short-term disruption to aquatic bird habitat during stone dike construction, as well as during any future dik maintenance periods, and when dredged material is being actively discharged into the CDF. . Eventual long-term loss of open water aquatic bird resting & feeding habitat (60 acres), with resultant conversion of the site to terrestrial wildlife habitat that would attract upland birds and small mammals. . Dike stone above the waterline would provide about 5,650 linear feet of long term resting/loafing habitat around the CDF perimet for seagulls, terns, and possibly some other bird species.
Threatened and Endangered Species	ST: Not Significant LT: Not Significant	ST: Not Significant LT: Not Significant . It is possible that on occasion, tran-sient individuals of piping plover and Indiana bat - both Federally listed endan-gered species - may briefly visit the area, since the vicinity of Cleveland Harbor is within the overall habitat range of these two species. Due to the project type and location, no significant adverse impacts on this plover or bat is anticipated by con-struction of the Site 10B (15-Yr.) CDF.	ST: Not Significant LT: Not Significant . No significant adverse impact on threatened or endangered species, as described for the Site 10B (15-Year) alternative plan.

Table 3 - Comparative Impacts of Detailed Plans (Cont'd)

Evaluation Parameter	No Action (Without Project Conditions)	Site 10B (15-Year) Confined Disposal Facility	Burke East Site (15-Year) Confined Disposal Facility
HUMAN ENVIRONMENT MAN-MADE RESOURCES			
Community and Regional Growth	ST: Moderate Adverse LT: Major Adverse . If the harbor channels could not be maintained for lack of a dredged material discharge area and allowed to silt in, enterprises and individuals dependent on t e channels to allow navigation and shipping would suffer economically and may eventually be displaced.	ST: Moderate Beneficial LT: Major Beneficial . Development of this alternative would allow for continued harbor channel maintenance dredging and confined discharge of polluted dredged material for about 15 years. About a 68-acre Outer Harbor area adjacent to Burke Lakefront Airport available for development. Probable long-term land use to expand or relocate airport facilities possibly making room for other Lakefront developments. Port Authority and City of Cleveland favor this site and would commit to local costs, including relocation of sewer lines.	ST: Minor Beneficial LT: Moderate Beneficial . Development of this alternative would allow for continued harbor channel maintenance dredging and confined discharge of polluted dredged material for about 15 years. About a 60-acre Outer Harbor area adjacent to the old CDF Site 12 available for development. Probable long-term land use to expand or relocate airport facilities possibly making room for other Lakefront developments. Port Authority and City of Cleveland do not favor this site. Water quality and land use concerns.
Displacement of People	ST: Minor Adverse LT: Moderate Adverse . If the harbor channels could not be maintained for lack of a dredged material discharge area and allowed to silt in, enterprises and individuals dependent on the channels to allow navigation and shipping would suffer economically and may eventually be displaced.	ST: Not Significant LT: Not Significant . No displacement of people. The Port Authority has obtained rights of Lake Erie bottom land from the State.	ST: Not Significant LT: Not Significant . No displacement of people. The Port Authority must obtain rights of Lake Erie bottom land from the State.
Displacement of Farms	ST: Not Significant LT: Not Significant . No displacement of farms.	ST: Not Significant LT: Not Significant . No displacement of farms.	ST: Not Significant LT: Not Significant . No displacement of farms.
Business/Industry Employment/Income	ST: Moderate Adverse LT: Major Adverse . If the harbor channels could not be maintained for lack of a dredged material discharge area and allowed to silt in, enterprises and individuals dependent upon the channels to allow navigation and shipping would suffer economically and may eventually be displaced.	ST: Moderate Beneficial LT: Major Beneficial . Construction of facility. Development of this alternative would allow for continued harbor channel maintenance dredging and CDF discharge of polluted dredged material for about 15 years. Dependent harbor business, industry, employment, and income would be facilitated.	ST: Moderate Beneficial LT: Major Beneficial . Construction of facility. Development of this alternative would allow for continued harbor channel maintenance dredging and CDF discharge of polluted dredged material for about 15 years. Dependent harbor business, industry, employment, and income would be facilitated.

Table 3 - Comparative Impacts of Detailed Plans (Cont'd)

Evaluation Parameter	No Action (Without Project Conditions)	Site 10B (15-Year) Confined Disposal Facility	Burke East Site (15-Year) Confined Disposal Facility
Public Facilities and Services	ST: Minor Adverse LT: Moderate Adverse . If the harbor channels could not be maintained for lack of a dredged material discharge area, and enterprises were displaced, associated land use dilapidation and/or redevelopment would likely occur. Industrial and commercial processes, transportation interfaces, and public facilities, services and utilities would need to be altered accordingly.	ST: Moderate Adverse LT: Moderate Beneficial . Six ~~storm~~ sewer outflows would need to be extended through the CDF site. Development of this alternative would provide for continued harbor channel maintenance dredging and CDF discharge of polluted dredged material for about 15 years. Dependent enterprises and associated facilities and services would likely be maintained. No significant disruption to public facilities or services would be expected due to project development.	ST: Minor Adverse LT: Moderate Beneficial . Development of this alternative would provide for continued harbor channel maintenance dredging and CDF discharge of polluted dredged material for about 15 years. Dependent enterprises and associated facilities and services would likely be maintained. No significant disruption to public facilities or services would be expected due to project development. Created embayment sewer outflow water quality concerns.
Recreational Resources	ST: Minor Adverse LT: Minor Adverse . If the harbor channels could not be maintained for lack of a dredged material discharge area and allowed to silt in, enterprises (including recreational) dependent upon the channels for navigation would suffer economically and could be displaced. Recreational navigation for deeper draft vessels, particularly sail boats could be reduced. Alternate recreational developments could occur.	ST: Minor Adverse LT: Minor Beneficial . Development of this alternative would provide for continued harbor channel maintenance dredging and CDF discharge of polluted dredged material for about 15 years. About a 68-acre Outer Harbor (boating) area adjacent to Burke Lakefront Airport lost. Pedestrian/fisherman access is a long term lakefront development consideration (peripheral) possibly facilitated/accommodated by CDF related future airport facility relocation or expansion. Should be consistent with ODNR lakefront park plans.	ST: Minor Adverse LT: Minor Beneficial . Development of this alternative would provide for continued harbor channel maintenance dredging and CDF discharge of polluted dredged material for about 15 years. About a 60-acre Outer Harbor (boating) area adjacent to the old Site 12 CDF lost. Additional stone dike (fishery habitat). Pedestrian/fisherman access is a long-term lakefront development consideration (peripheral) possibly facilitated/accommodated by CDF related airport facility relocation or expansion. Existing marina view and access concerns. Should be consistent with ODNR lakefront park plans.
Property Values and Tax Revenues	ST: Minor Adverse LT: Moderate Adverse . If the harbor channels could not be maintained for lack of a dredged material discharge area, and enterprises were displaced, associated land use dilapidation and/or redevelopments would likely occur. Higher property values and associated tax revenues associated with industrial and commercial channel access lakefront developments would likely be lost to less intensive lakefront and recreational-type developments.	ST: Minor Adverse LT: Minor Beneficial . Construction of facility. Local project cost share. Development of this alternative would provide for continued harbor channel maintenance and CDF discharge of dredged polluted material for about 15 years. This would serve to maintain existing harbor channel dependent enterprises, property values, and associated tax revenues. About 68 acres of waterfront property would eventually be created adjacent to Burke Lakefront Airport and likely utilized to expand or relocate airport facilities possibly making room for other lakefront developments.	ST: Minor Adverse LT: Minor Beneficial . Construction of facility. Local project cost share. Development of this alternative would provide for continued harbor channel maintenance and CDF discharge of polluted dredged material for about 15 years. This would serve to maintain existing harbor channel dependent enterprises, property values, and associated tax revenues. About 60 acres of waterfront property would eventually be created adjacent to the old CDF Site 12, and likely utilized to expand or relocate airport facilities, possibly making room for other lakefront developments.

Table 3 - Comparative Impacts of Detailed Plans (Cont'd)

Evaluation Parameter	No Action (Without Project Conditions)	Site 10B (15-Year) Confined Disposal Facility	Burke East Site (15-Year) Confined Disposal Facility
Noise and Aesthetics	ST: Not Significant LT: Minor Adverse . If the harbor channels could not be maintained for lack of a dredged material discharge area, and enterprises were displaced, associated land use dilapidation and/or redevelopment would likely occur. Associated changes in noise and aesthetics.	ST: Minor Adverse LT: Not Significant . Project construction noises and aesthetics. Similar to existing harbor noises and aesthetics. Probable long-term land use to expand or relocate airport facilities. Pedestrian and fisherman access is a consideration in long term lakefront development (peripheral) possibly facilitated/accommodated by CDF related future airport facility relocation or expansion.	ST: Moderate Adverse LT: Moderate Adverse . Project construction noises and aesthetics. Similar to existing harbor noises and aesthetics. Probable long-term land use to expand or relocate airport facilities. Construction of this facility would alter distant views to and from the lake in the vicinity of the East Basin. Created embayment sewer outflow water quality concerns. Pedestrian and fisherman access is a consideration in long-term lakefront development (peripheral) possibly facilitated/accommodated by CDF related future airport facility relocation or expansion.
Community Cohesion	ST: Moderate Adverse LT: Major Adverse . If the harbor channels could not be maintained for lack of a dredged material discharge area, channel navigation dependent enterprises (which could suffer economically and may eventually be displaced) would likely be gravely concerned.	ST: Minor Adverse LT: Moderate Beneficial . Project Costs. . Development of this alternative would allow for continued harbor channel maintenance dredging and CDF discharge of polluted dredged material for about 15 years. Dependent enterprises would be facilitated. About a 68-acre Outer Harbor (protected and littoral) area adjacent to Burke Lakefront Airport would be lost. Port Authority and City of Cleveland favor this site and would commit to local costs, including relocation of sewer lines.	ST: Moderate Adverse LT: Minor Beneficial . Project Costs. . Development of this alternative would allow for continued harbor channel maintenance dredging and CDF discharge of polluted dredged material for about 15 years. Dependent enterprises would be facilitated. About a 60-acre Outer Harbor (protected and littoral) area adjacent to old CDF Site 12 would be lost. Port Authority and city of Cleveland do not favor this site. Water quality and land use concerns.
CULTURAL RESOURCES	ST: Not Significant LT: Minor Adverse . If the harbor channels could not be maintained and enterprises were displaced, associated land use dilapidation and/or redevelopment would likely occur. Unless cultural resources studies were conducted, it is probable that cultural resources would be disturbed or lost due to land use changes.	ST: Not Significant LT: Not Significant . The results of cultural resources review and coordination with the SHPO indicate that the considered project would have no effect on properties listed or eligible for listing on the National Register of Historic Places.	ST: Not Significant LT: Not Significant . The results of cultural resources review and coordination with the SHPO indicate that the considered project would have no effect upon properties listed or eligible for listing on the National Register of Historic Places.

Summary Table 4 - Relationship of Plans to Environmental Protection Statutes and Other Environmental Requirements

	Site 108 15-Year CDF	Burke East Site 15-Year CDF
<u>Federal Statutes</u>		
Archeological and Historic Preservation Act, as amended, 16 USC 469, <u>et seq.</u>	Full	Full
National Historic Preservation Act, as amended, 16 USC 470a, <u>et seq.</u>	Full	Full
Fish and Wildlife Coordination Act, as amended, USC 661, <u>et seq.</u>	Full	Full
Endangered Species Act, as amended, 16 USC 1531, <u>et seq.</u>	Full	Full
Clean Air Act, as amended, 42 USC 7401, <u>et seq.</u>	Full	Full
Clean Water Act, as amended (Federal Water Pollution Control Act), 33 USC 1251, <u>et seq.</u>	Full	Full
Federal Water Project Recreation Act, as amended, 16 USC 460-1(12), <u>et seq.</u>	Full	Full
Land and Water Conservation Fund Act, as amended, 16 USC 4601-11, <u>et seq.</u>	Full	Full
National Environmental Policy Act, as amended, 42 USC 4321, <u>et seq.</u>	Full	Full
Rivers and Harbors Act, 33 USC 401, <u>et seq.</u>	Full	Full
Wild and Scenic Rivers Act, as amended, 16 USC 1271, <u>et seq.</u>	Full	Full
Coastal Zone Management Act, as amended, 16 USC 1451, <u>et seq.</u>	Full	Full
Estuary Protection Act, 16 USC 1221, <u>et seq.</u>	N/A	N/A
Marine Protection, Research and Sanctuaries Act, 22 USC 1401, <u>et seq.</u>	N/A	N/A
Watershed Protection and Flood Prevention Act, 16 USC 1001, <u>et seq.</u>	Full	Full
Farmland Protection Policy Act, (7 USC 4201) <u>et seq.</u>	Full	Full
FAA Notice of Proposed Construction of Alteration	Full	N/A
<u>Executive Orders, Memoranda, Etc.</u>		
Protection and Enhancement of the Cultural Environment (EO 11593)	Full	Full
Flood Plain Management (EO 11988)	Full	Full
Protection of Wetlands (EO 11990)	Full	Full
Environmental Effects Abroad of Major Federal Actions (EO 12114)	Full	Full
Analysis of Impacts on Prime and Unique Farmlands (CEQ memorandum, 30 Aug 76)	Full	Full
Local Land Use Plans	Full	Full

The compliance categories used in this table were assigned based on the following definitions:

a. Full compliance - All requirements of the statue, EO, or other policy and related regulations have been met for this stage of the study.

b. Partial Compliance - some requirements of the statute, EO, or other policy and related regulations, which are normally met by this stage of planning, remain to be met.

c. Noncompliance - None of the requirements of the statute, or other policy and related regulations have been met.

d. N/A - The statute, EO, or other policy and related regulations are not applicable for this study.

9. COORDINATION

The proposed project has been and/or is being coordinated with Federal, State and local agencies, special interest groups, and private industry during the site selection and project planning process. These agencies include the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the U.S. Coast Guard, Ohio Department of Natural Resources, Ohio Department of Transportation, Ohio Environmental Protection Agency, Ohio Historic Preservation Office, the City of Cleveland, Cleveland-Cuyahoga County Port Authority, Cuyahoga County Commissioners, Northeast Ohio Area Council of Governments, Cleveland Waterfront Coalition, North Coast Development Corporation, Lake Carriers Association, and the International Longshoreman's Association, local citizens, environmental groups, and public officials. Four meetings were held during the initial study and two additional meetings were held in 1988 to discuss the site proposed in the September 1989 Supplemental Letter Report. The Buffalo District met with City of Cleveland officials in February 1991 to discuss the Burke East 15-year CDF site. The meeting led to the termination of work on the Burke East site and identified Site 10B as the proposed CDF location presented in this Letter Report.

10. CONCLUSIONS

The majority of sediments dredged from the Cuyahoga River and Cleveland Harbor, Cleveland, Ohio, are classified as polluted and not suitable for unrestricted open-water disposal. Approximately 300,000 cubic yards of polluted sediments are dredged annually from the harbor and Federal channels and require containment.

Site 10B is the selected containment site for these sediments. The estimated first cost of construction of a CDF at this site is $32,880,000 (August 1991 price levels) which includes $3,980,000 associated with the extension of six storm sewer outfalls. Site 10B has a benefit-to-cost ratio of 1.78 and provides approximately 15 years of capacity. The project is considered to be reasonably environmentally acceptable. When the Site 10B CDF is filled it will allow for expansion of the Burke Lakefront Airport.

The raising of Dike 14 remains a necessary as part of the overall plan to dispose of polluted sediments dredged from Cleveland Harbor. The raising will be undertaken when required to provide interim capacity until the Site 10B site is constructed. The raising of Dike 14 will be in accordance with the raising of Dike 14, Cleveland, Ohio, Design Analysis dated June 1989 (approval pending completion of NEPA process).

11. RECOMMENDATION

It is recommended that the proposed plan to construct a new CDF at Site 10B for the containment of polluted dredged material from Cleveland Harbor be approved as the basis for preparation of the design analysis.

APPENDIX A

CORRESPONDENCE

City of Cleveland

MICHAEL R. WHITE, MAYOR

CITY PLANNING COMMISSION
HUNTER MORRISON, DIRECTOR

501 CITY HALL
CLEVELAND, OHIO 44114
(216) 664-2210

February 4, 1992

Mr. George B. Brooks, P.E.
Engineering/Planning Division
Chief
U.S.A. Army Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207-3199

ATTENTION: David Gerland

Dear Mr. Brooks:

Thanks for your December 18, 1991 response to my request for your preliminary cost estimate for the Cleveland Burke West CDF (Site 10B), including your trunk sewer outfall extension cost estimates, the latter of which we understand are to be funded by others.

Your sewer estimates are related to sewer sizes without location identification. Our records show totally different pipe arch sizes than those you listed. Also, nowhere in our records can we locate the present outfall location of the East 38 Street pipe arch sewer. It was obviously extended when you constructed Site 13 but does not show on our sewer maps.

In the interest of coordination, we are asking our Port Control Director, Cynthia Rich to send you all the assembled sewer map data for Site 10B as an enclosure to the city's "expression of interest" package which was discussed in our January 28, 1992 telecon with you and David Gerland. It should reach you in the near future.

Thanks again for your cooperation.

Sincerely,

Hunter Morrison
Planning Director

HM/LW:ke
CC: Joseph Zalenski; Layton Washburn

An Equal Opportunity Employer

SEP - 9 1991

Study Management/Project Engineering Branch

SUBJECT: Confined Disposal Facilities (CDF), Cleveland, Ohio

9 SEP 91 13 34

Honorable Michael R. White
Mayor, City of Cleveland
601 Lakeside Avenue, N.E.
City Hall - Room 106
Cleveland, Ohio 44114

Dear Mayor White:

The meeting of February 14, 1991, with members of your staff, Mr. George Brooks and Mr. Richard Mammoser of my staff, was both productive and informative. At the meeting, the City and the Corps agreed that the Burke East site would no longer be considered for construction of the new CDF. The Corps also agreed to consider an alternate site along the Burke Airfield for development of the CDF. With receipt of your August 9, 1991 Letter of Intent to act as the Local Sponsor, I have initiated the first steps to develop this site. The purpose of this letter is to acknowledge your letter, to advise you of certain requirements for which you will be responsible, and to update you on the overall schedule for the CDF program. Copies of the preliminary CDF development schedules are attached for your reference.

In order to construct the CDF along Burke Airfield, it will be your responsibility as the Local Sponsor to provide for relocations/modifications of the storm sewer culverts that are located along the north edge of the existing fill. Available drawings indicate that there are six such culverts. Since these utility relocations/modifications should proceed or be incorporated into the CDF construction, your designs should be initiated as soon as possible. The Buffalo District is willing to perform this engineering, and/or construction on a cost reimbursable basis. If you desire the Corps to accomplish this engineering work, funds would have to be agreed to and provided by the city of Cleveland before the engineering work begins. Please advise me if you would like the Corps to perform this engineering and construction effort.

The Local Sponsor will also be required to furnish all Lands, Easements, and Rights-of-Way (LER) necessary for construction, operation, and maintenance at the CDF.

Study Management/Project Engineering Branch
SUBJECT: Confined Disposal Facilities (CDF), Cleveland, Ohio

As discussed at the February 14, 1991 meeting, the CDF at the newly selected site could be complete and ready for use in time for the 1997 dredging season. Since the existing capacity of Dike 14 will be exhausted by about 1994, I am proceeding with plans to modify the Dike 14 facility and extend its life by about 3 years. As previously agreed, we will only use the additional capacity at Dike 14 until we have another disposal site ready for use.

I am encouraged by the agreement relative to the location of the new Cleveland CDF. Mr. Richard Mammoser of my Study Management/Project Engineering Branch, will continue to coordinate and work with Mr. Joseph Zalenski of your Economic Development Department, to assure timely completion of this most necessary project. Please contact Mr. Mammoser at 716-879-4229 if additional information is required.

Sincerely,

SIGNED

John W. Morris
Colonel, U.S. Army
Commanding

Enclosure

Mammoser:emp:9/2/91:4229
DeJohn:CENCB-PE-S MGD 9/6/91
Gilbert/Brooks:CENCB-PE CEG 9/6
MAJ Plank:CENCB-DE
COL Morris:CENCB-DE

DIRECTORY: # WP Mammoser #2
NAME OF DOCUMENT: Cleve.CDF

City of Cleveland

MICHAEL R. WHITE, MAYOR

DEPARTMENT OF LAW

CRAIG S. MILLER
DIRECTOR

ROOM 106 • CITY HALL
601 LAKESIDE AVENUE
CLEVELAND, OHIO 44114
(216) 664-2800

August 9, 1991

Colonel John W. Morris
Department of the Army
Buffalo District - Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207-3199

Attention: Mr. Richard Mammoser

Re: New Confined Disposal Facility
at Cleveland, Ohio

Dear Colonel Morris:

The City of Cleveland will agree to act as the Local Sponsor for a Confined Disposal Facility ("CDF") to be constructed and filled by the Army Corps of Engineers, at a site located along the northern shoreline of Burke Lakefront Airport in Cleveland, Ohio. This new site is a modified version of the previously studied Sites 10 and 10A, which the City will denominate as site 10B for purposes of this notice. Attached is an Exhibit A to this letter describing this new site.

The City will bear the cost of the sewer extensions needed to complete this project.

The City will enter into a Local Cooperation Agreement ("L.C.A.") with the Army Corps of Engineers for the construction, maintenance and filling of the Dike, provided that the City and Corps can reach agreement on the terms of the L.C.A., and provided that such an agreement is authorized by Cleveland City Council.

Director Cynthia D. Rich, of the Department of Port Control of the City, has administrative authority over Burke Lakefront Airport and the City Harbor. She will act on behalf of the City as the official contact throughout the project.

She may be contacted at the following address:

Cynthia D. Rich, Director
Department of Port Control
Second Floor - Passenger Terminal Building
Cleveland Hopkins International Airport
5300 Riverside Drive
Cleveland, Ohio 44135-3193
(216) 265-6022.

The City's Law Department will coordinate the discussions concerning the L.C.A. The contact person is William M. Ondrey Gruber, who can be contacted at the following address:

William M. Ondrey Gruber
Chief Assistant Director of Law
Room 106 - City Hall
601 Lakeside Avenue
Cleveland, Ohio 44114
(216) 664-2693.

If you have any questions, please contact Joseph Zalenski, the City's CDF Project Manager at (216) 664-3671, or Bill Gruber at the telephone number listed above.

I appreciate the Corps' cooperation in determining the location of a new CDF, and I hope that the new site can be constructed and brought into service as soon as possible.

Very truly yours,

Michael R. White
Mayor, City of Cleveland

MRW:lls
cc: Cynthia D. Rich
Joseph A. Marinucci
Lawrence Kassouf
David Fleshler
Ron Toth
Michael Barth
Hunter Morrison
Joseph Zalenski
Barbara J. Danforth
William M. Ondrey Gruber
Admiral Fugaro

Exhibit A

July 29, 1991

Confined Disposal Facility at Burke Lakefront Airport - Site 10B

Metes and Bounds

Starting at the southwesterly corner of CDF SITE 13; thence 450 ft.± to the northwesterly corner of CDF SITE 13; thence 900 ft.± to the northeasterly corner of CDF SITE 13; thence 400 ft.± to the northwesterly corner of CDF SITE 9; thence 4,500 ft.± westerly along the prolongation of the northerly line of CDF SITES 9 & 12; thence 550 ft.± southerly at right angles to a point in the northerly line of Burke Lakefront Airport; thence 3,600 ft.± easterly along the northerly line of Burke Lakefront Airport to the place of beginning, containing therein 68 acres, more or less.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

IN REPLY REFER TO:

Reynoldsburg Field Office
6950-H Americana Parkway
Reynoldsburg, Ohio 43068-4115
(614) 469-6923

LOF J...
10...

February 12, 1991

Colonel John W. Morris
District Engineer
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Attention: Len Brynarski:

Dear Colonel Morris:

Len Brynarski has advised us that Site 10 Confined Disposal Facility is again under consideration for construction in the Cleveland Harbor area. Site 10 (a proposed 86 acre site) would be located adjacent to Burke Lakefront Airport.

At this time, we do not believe that additional field studies would be needed if this site is selected as the location for a Cleveland Harbor Confined Disposal Study. However, we would require some time to review existing data and/or studies and prepare Fish and Wildlife Coordination Act reports.

Sincerely,

William J Kurey

William J. Kurey

Acting Supervisor

APPENDIX B

ECONOMIC EVALUATION

CLEVELAND HARBOR
LETTER REPORT
ON CONFINED DIKE DISPOSAL PROJECT
CLEVELAND, OHIO

TABLE OF CONTENTS

TABLES

Tables- Continued

Tables- continued

FIGURES

CLEVELAND HARBOR
LETTER REPORT
ON CONFINED DIKE DISPOSAL PROJECT
CLEVELAND, OHIO

B1. INTRODUCTION

a. Report Purpose.

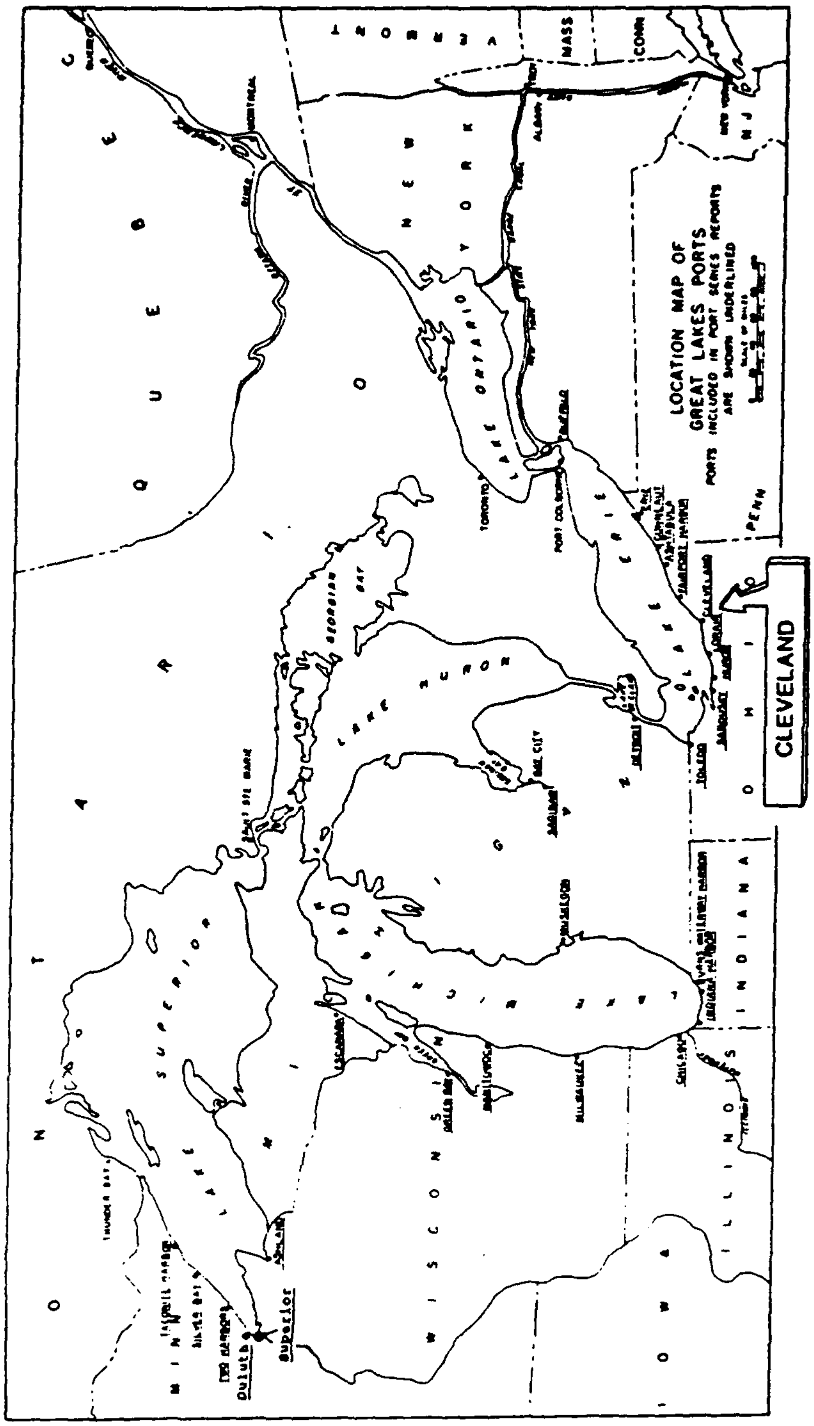
The purpose of this letter report is to determine the economic feasibility of constructing a confined disposal facility (cdf) at Site 10B for the containment of bottom sediment dredged from the federal navigation channels at Cleveland Harbor. The CDF would provide a facility to contain polluted materials dredged from the Cleveland Harbor. If the facility were not constructed, Cleveland Harbor could not be dredged. The CDF is necessary to maintain adequate shipping channel depths. If adequate navigation channel depths are not maintained, the efficiency of Great lakes fleet Carriers would be greatly reduced and could result in uneconomic operations. If this situation developed, Cleveland Harbor could cease to exist as a viable harbor. Thus the CDF is necessary for the continued economic viability of Cleveland Harbor.

The impact of discontinuing dredging at Cleveland Harbor will impact on the transportation costs of the four major bulk commodities using the harbor: iron ore, limestone, salt and cement. The termination of dredging will result in the continual shoaling of the federal channels. This in turn will decrease the draft that commercial vessels can enter the harbor at. This decrease in commercial vessel draft will result in less tons of bulk commodities being carried by freighters per trip to/from the harbor. More trips will have to be made to deliver the same amount of bulk materials to the various end users. This will result in an increase in transportation costs for bulk commodities, over time, as the shoaling continues. As the transportation costs for the waterborne mode increase at Cleveland Harbor, water becomes less competitive as a transportation mode. Traffic ultimately could shift to other Great Lakes harbors, shift to alternative modes such as rail, or cease to exist since the industries served by waterborne movements could become uncompetitive at existing plant locations. This increase in transportation cost will be compared to the cost of building the proposed dike disposal at Site 10B.

b. Location And Tributary Area.

Cleveland Harbor is on the south shore of Lake Erie, at the mouth of the Cuyahoga River. The harbor is 33 miles southwest of Fairport Ohio, and 28 miles northeast of Lorain, Ohio (see Figure B1.) The city of Cleveland is situated on the East and West bank of the Cuyahoga River, near its mouth. The city is located in Cuyahoga County. The Cuyahoga River drainage basin covers approximately 810 square miles.

Figure B1- Location Map.



c. Project Dimensions.

An overview of the federal harbor is provided in Figures B2 and B3. The major project components follows.

1. The Port of Cleveland consists of an Outer Harbor and an Inner Harbor. The Outer harbor consists of a five mile long breakwall protected lakefront. the Inner Harbor consists of the lower, deep draft section of the Cuyahoga River, and connecting Old River.

2. The Outer Harbor has two entrances from Lake Erie (See Figure B2.). The west (main) entrance is through a dredged channel at the west end of the Outer Harbor. This entrance is between the outer ends of the two converging breakwaters (east and west arrowhead breakwaters) extending outward from the east and west basin breakwaters. The other entrance is at the east end of the Outer Harbor area between the breakwater and the shore.

The west entrance has a 29 foot deep lake approach channel, which flares from deep water in the lake to a channel width of 600 feet between the outer ends of the Arrowhead breakwaters. A 28 foot deep entrance channel extends from the inner end of the lake approach channel, through the outer harbor to the lakeward ends of the piers at the mouth of the Cuyahoga River. The entrance channel varies in width from 750 to 220 feet.

3. The Inner harbor includes about 5.8 miles of the Cuyahoga River and about one mile of the Old River, the former outlet of the Cuyahoga River (See Figure B3). The Old River extends westward from a point about 0.4 mile above the mouth of the Cuyahoga River. The mouth of and entrance channel to the Cuyahoga River are in line with the main entrance to the Outer Harbor from the lake. The entrance channel is protected by two parallel piers, 325 feet apart. Widths in the Cuyahoga River vary from 130 to 325 feet, except at the bends and in the existing turning basin, where a width of 800 feet is available. the turning basin is located 4.8 miles above the mouth. The project provides a depth of 27 feet in the lower Cuyahoga River from the lakeward end of the piers to immediately above the junction with the Old River. The remainder of the Cuyahoga to the vicinity of mile 5.8 has a depth of 23 feet. The Old River is maintained to a depth of 23 feet to the Sand Products Corporation Dock. The remainder of the Old River is maintained at 21 feet.

d. Site Evaluated.

One confined disposal facility site will be evaluated. This site, Site 10B, runs adjacent to and north of the Burke airfield within Cleveland Harbor Lakefront Airport. (See Figure B4). The CDF attaches to former Corps of Engineers disposal areas located east of the airport, and extends 4,500 feet westward, parallel to the east entrance channel. The CDF will enclose approximately 70

Figure B2- Cleveland Harbor Project Map- Outer Harbor.

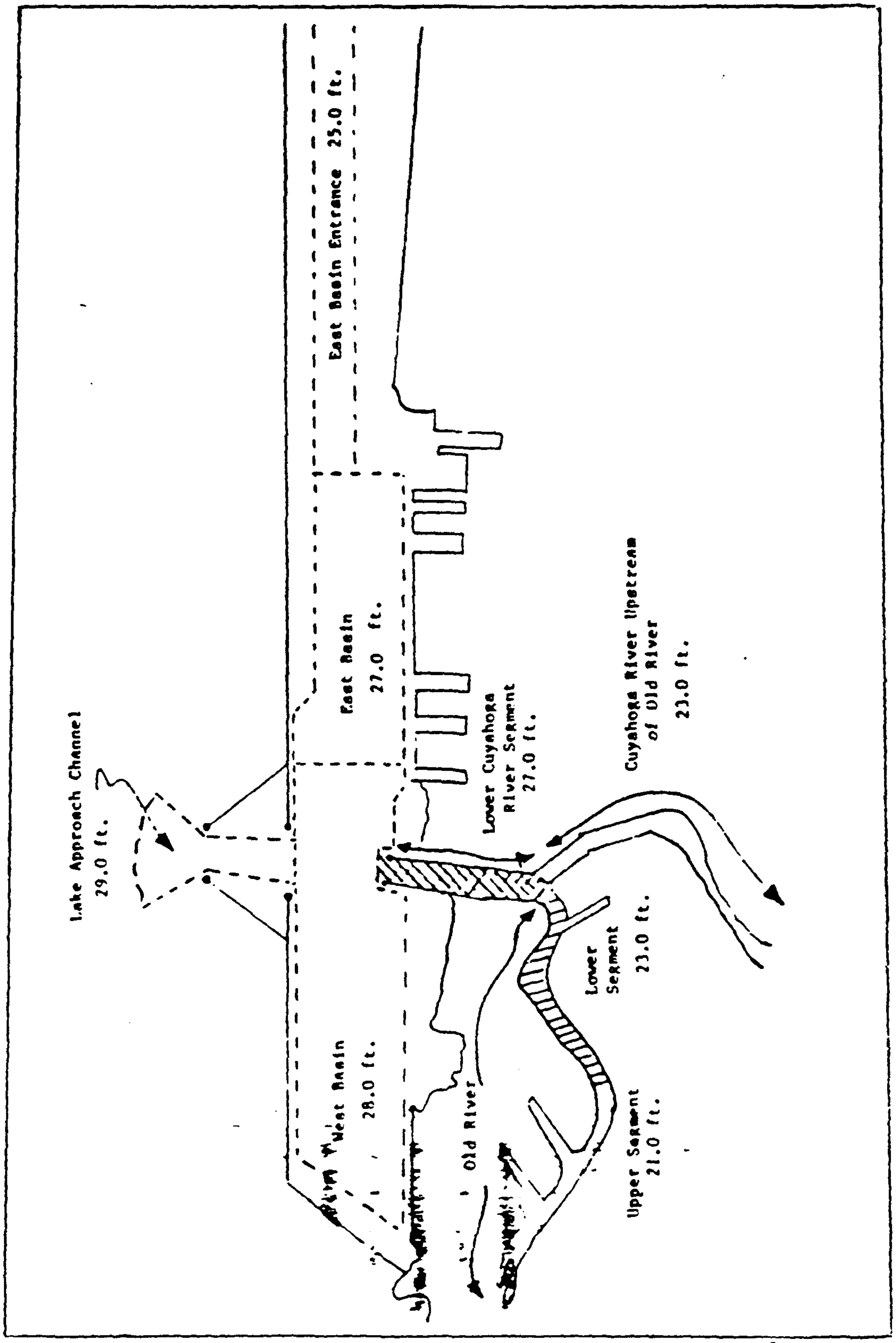


Figure B3- Cleveland Harbor Project Map- Cuyahoga and Old River.

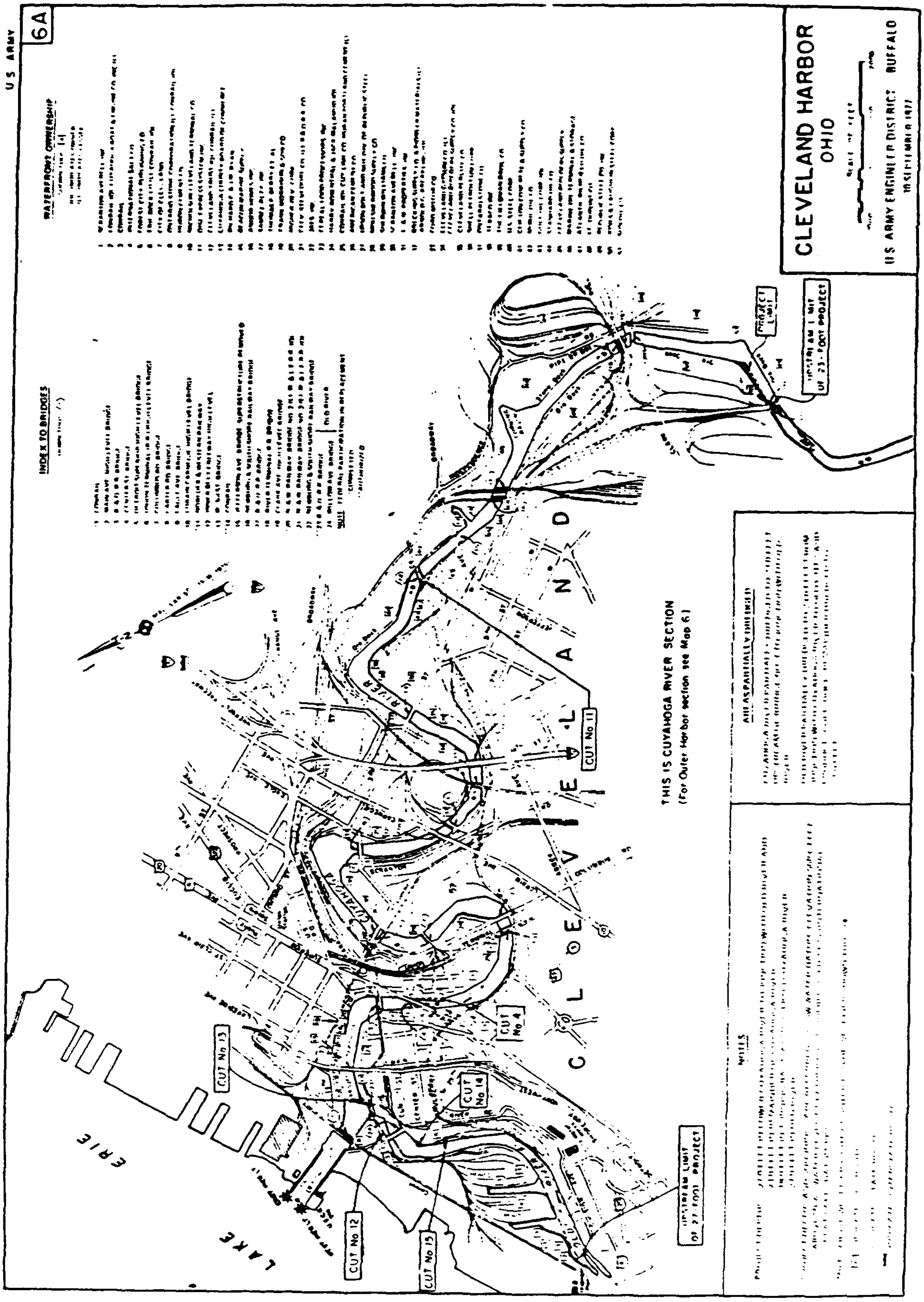
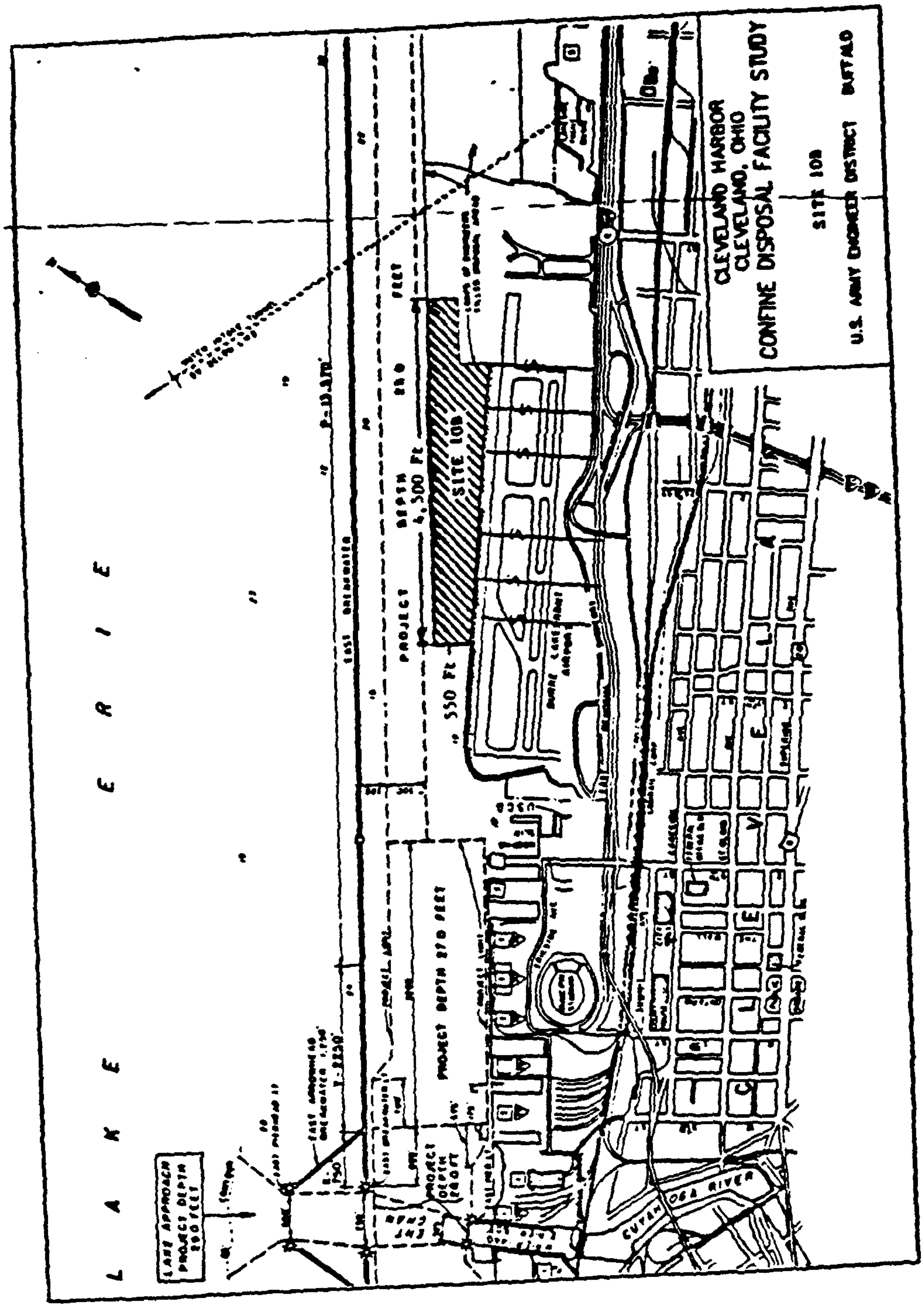


Figure B4. - Location Of CDF Site 10B



acres, have a holding capacity of 3,500,000 cubic yards, have a dike elevation of + 14 feet lwd, and cost approximately $32m. Construction is scheduled to begin in 1994, take three years to complete, and be completed in 1997.

e. Project Evaluation Procedures.

The current evaluation will compare the cost of building the described disposal facility to the increase in transportation costs if dredging maintenance were discontinued. The evaluation period starts in 1997, will have a fifty year evaluation period, use the current federal discount rate of 8.50 percent and reflect August 1991 prices.

Benefits to the project will be the difference in transportation costs for the four major bulk commodities (iron ore, limestone, salt and cement) between the "without project" condition and the "with project" condition.

The "without project" condition assumes maintenance dredging will take place up to 1997. No maintenance dredging will be performed during the evaluation period: 1997 to 2047. This will result in the Outer Harbor, the Cuyahoga River and the Old River shoaling up to some equilibrium channel elevation. The equilibrium channel elevations for the Outer Harbor, the Cuyahoga River and the Old River are: 19 feet below lwd, 15 feet below lwd and 15 feet below lwd respectively. Annual transportation costs during the 50 year evaluation period will be calculated under the "without project" condition for affected bulk commodities. Annual transportation costs will be affected by the shoaling rates that pertain to the Outer Harbor, the Cuyahoga River and the Old River. The time stream of these transportation costs will be converted to an average annual dollar value, given an 8.50 percent annual interest rate and a 50 year evaluation period.

Average annual transportation costs under "with project" conditions will also be calculated for the four major bulk commodities. Site 10 B is assumed to hold 15 years of dredging. Consequently dredging will take place from project year 1 to project year 15. Dredging will be discontinued from project year 16 to project year 50. Thus under the "with project" condition, transportation costs from project year 1 to project year 15 will be equal to current transportation costs. Shoaling of the channels will commence in project year 16 and continue until equilibrium channel depths have been reached. Transportation costs will increase from project year 16 to the year when all the channels have attained their equilibrium channel depths. This time stream of transportation costs will be converted to an average annual dollar value, given an 8.50 percent annual interest rate and a 50 year evaluation period.

Annual shoaling rates will be used as inputs to determining annual transportation costs under the "without" and "with" project conditions over the evaluation period. The number of

years of dredging the dike can accommodate will have an impact on the "with project condition" transportation costs. Average annual "with project" condition transportation costs will be reduced as the number of years of dredging the dike can accommodate increases. This is because the increase in transportation costs due to shoaling will be deferred further into the future as the cubic capacity of the dike disposal area increases.

B2. COMMERCIAL NAVIGATION.

a. Introduction.

This section will describe the current major harbor users that will be impacted by deferred maintenance of existing authorized Federal channels; estimate tonnage levels affected; present shoaling rates throughout the harbor over the evaluation period; evaluate the harbors traffic patterns with respect to origin-destination routes by commodity by ship size; develop transportation costs over the evaluation period for the "without project" condition and the "with project" condition for iron ore, limestone, salt and cement; and convert these transportation costs to average annual transportation costs.

b. Tonnage Levels.

Table B1 presents historical tons of iron ore, limestone, salt and cement received/shipped at Cleveland Harbor. Average yearly iron ore shipments between 1984 and 1989 was 8,342,289 short tons. Iron ore shipped from Canadian ports to Cleveland Harbor has averaged approximately 1,120,603 tons between 1984 and 1989. This is approximately 13 percent of annual iron ore receipts over this period.

Average yearly limestone receipts between 1984 and 1989 was 2,036,949 short tons. All receipts were from U. S. ports during this time period.

Average yearly salt shipments between 1984 and 1989 was 840,997 short tons. Approximately 61 percent (513,978 short tons) of the shipments were to U. S. ports.

Average yearly cement receipts between 1984 and 1989 was 447,675 short tons. Over 89 percent (398,611) of cement receipts have typically come from U. S. ports.

Average yearly tonnages for these four commodities are 11,667,910 from 1984 to 1989. The origin /destination routes of these commodities, and the vessels that service these routes are inputs needed to perform the transportation cost analysis. Tonnage levels exhibited during the 1989 navigation season were felt to be representative of future commodity movements through the harbor during the evaluation period. Consequently, 1989 traffic levels and movements were taken as being representative

TABLE B1 - HISTORICAL TONNAGES AT CLEVELAND HARBOR 1984 TO 1989

Table B1.- Historical Tonnages At Cleveland Harbor- 1984- 1989

	1984	1985	1986	1987	1988	1989	Average Tons
Iron Ore Receipts							
Foreign		42,691					7,115
Canadian	1,230,217	992,423	890,594	889,354	1,157,288	1,563,741	1,120,603
Domestic	7,786,150	7,393,173	6,146,371	7,633,268	7,709,853	6,618,610	7,214,571
Subtotal	9,016,367	8,428,287	7,036,965	8,522,622	8,867,141	8,182,351	8,342,289
Limestone Receipts							
Domestic	1,142,888	1,645,739	1,789,433	2,336,037	2,640,008	2,667,590	2,036,949
Salt Shipments							
Foreign	25,153	15,421	7,293	-	1,265	19,630	11,460
Canadian	303,027	340,654	377,437	153,457	299,122	419,651	315,558
Domestic	592,887	574,650	600,176	435,452	356,242	524,462	513,978
Subtotal	921,067	930,725	984,906	588,909	656,629	963,743	840,997
Cement Receipts							
Canadian	-	-	29,511	84,071	86,368	94,435	49,064
Domestic	373,685	380,348	372,078	413,205	441,163	411,188	398,611
Subtotal	373,685	380,348	401,589	497,276	527,531	505,623	447,675
Commodity Subtotals	11,454,007	11,385,099	10,212,893	11,944,844	12,691,309	12,319,307	11,667,910
Total Harbor Tonnage	12,920,708	13,767,174	12,188,278	13,914,047	14,550,876	14,687,619	13,671,450
Comm As % Total	88.65%	82.70%	83.79%	85.85%	87.22%	83.88%	85.35%

for the evaluation period and were used as inputs to perform the transportation cost analysis under "without" and "with project" conditions.

c. Current Major Harbor Users.

The federal channels in Cleveland Harbor, Ohio, comprise the focal point for bulk transportation activities in this city (Figures 2 and 3). Although local industry accounts for a small portion of the commerce through the port, the primary movement of commerce entails the transshipment of dry bulk commodities to or from interior points. Four bulk commodities have historically accounted for over 82 percent of the commercial traffic entering/leaving the harbor. These four bulk commodities are iron ore, limestone, salt and cement. The major docks involved in the handling of these commodities, and their locations are presented in Table B2.

Table B2. Location of Cleveland Harbor Docks Involved In Bulk Commodity Movements

COMMODITY	DOCK	OPERATOR	LOCATION
Iron Ore	Dock 10	C&P	West Basin-Whiskey Island
	Dock 55		West Basin-Whiskey Island
	Dock 50	Ontario Stone	Mouth Of Cuyahoga
	Dock 160	Ontario Stone	Old River
	Dock 250	United Ready Mix	Cuyahoga River
	Dock 410	LTV Steel	Upper Cuyahoga River
	Dock 435	LTV Steel	Upper Cuyahoga River
	Dock 440	LTV Steel	Upper Cuyahoga River
Limestone			
	Dock 50	Ontario Stone	Mouth Of Cuyahoga
	Dock 77	Ontario Stone	Old River
	Dock 160	Ontario Stone	Old River
	Dock 250	United Ready Mix	Lower Cuyahoga River
	Dock 598	Ford Motor	Middle Cuyahoga River
	Dock 580		Middle Cuyahoga River
	Dock 329	Cleveland Builders	Middle Cuyahoga River
	Dock 360	Clifton Concrete	Middle Cuyahoga River
	Dock 378	Cleveland Builders	Middle Cuyahoga River
	Dock 410	LTV Steel	Upper Cuyahoga River
	Dock 435	LTV Steel	Upper Cuyahoga River
	Dock 440	LTV Steel	Upper Cuyahoga River
Salt	Dock 115	International Salt	Old River
Cement	Dock 178	Huron Cement	Old River
	Dock 673	Medusa Cement	Cuyahoga River

The harbor itself has been divided into four distinct areas: the Outer harbor, the Old River and the Lower Cuyahoga, The Middle Cuyahoga and the Upper Cuyahoga (See Figure B5). The "Outer Harbor" consists of all docks located at the Lake Front.

Figure B5. Harbor Reaches

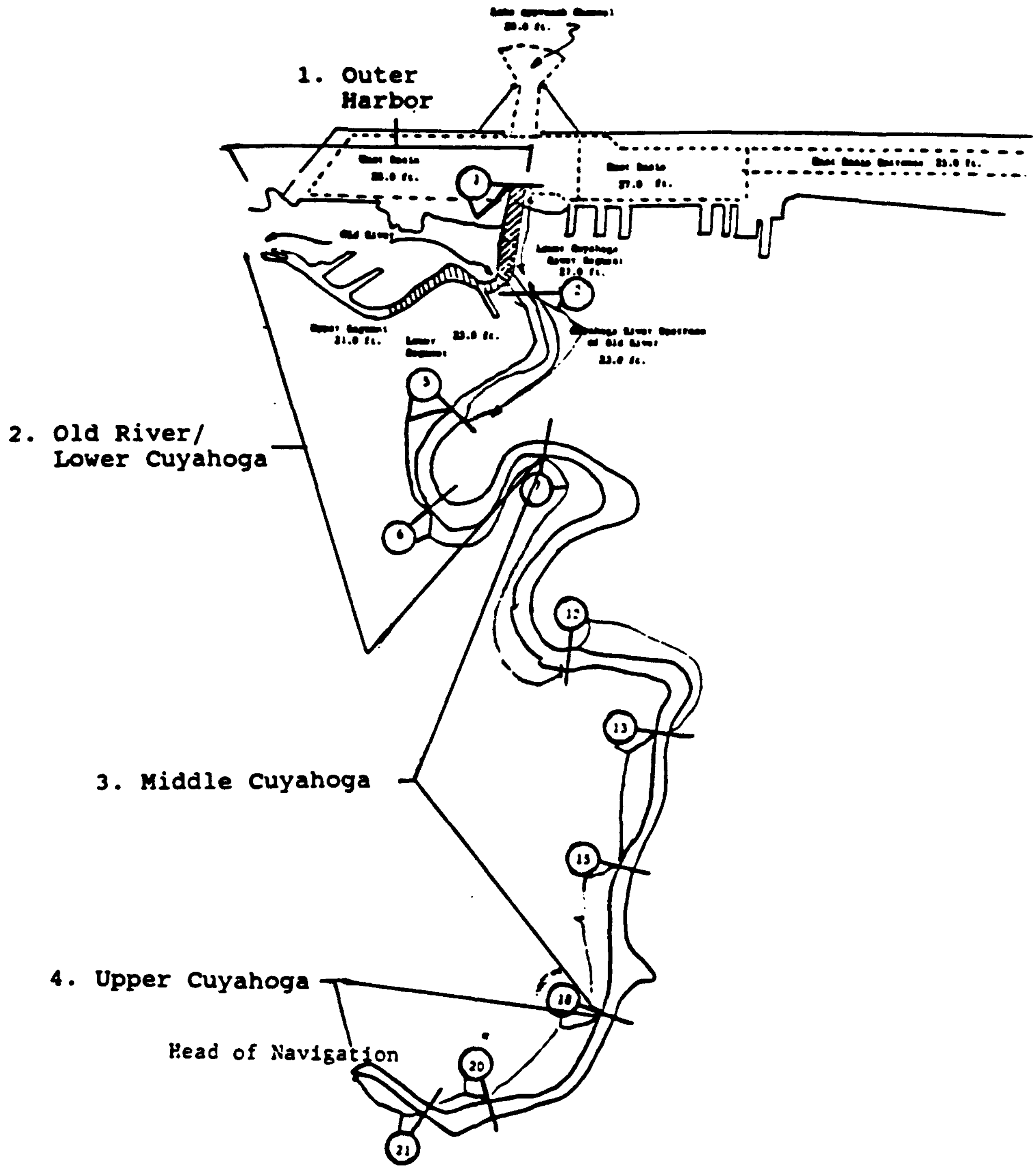
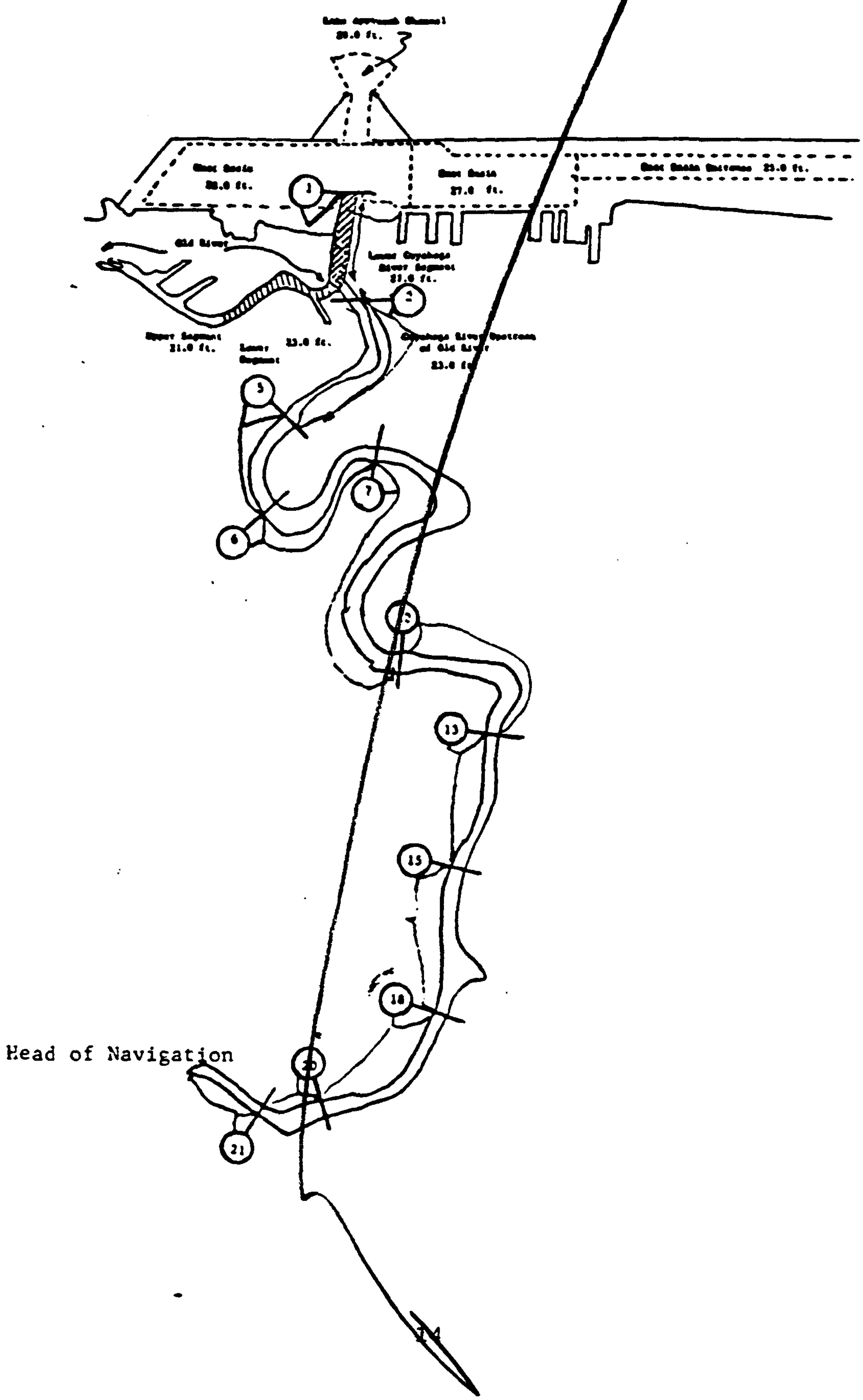


Figure B 6 Harbor Section Developed For Shoaling Analysis



The "Old River and Lower Cuyahoga" consists of all docks located on the Old River as well as all docks located on the Cuyahoga River up to the Carter Road Bridge. The "Middle River" includes all docks located on the Cuyahoga River between the Carter Road Bridge and the upper end of the Turning Basin. This is approximately 2.6 miles. The Upper Cuyahoga consists of all docks located between the upper end of the Turning Basin and the head of commerical navigation.

Affected commodity tonnages for 1989 were subdivided by the four harbor reaches. Table B3 summarizes affected harbor tonnages by harbor reach. A brief description of the commercial traffic patterns of the harbor follows.

Table B3. Affected Harbor Tonnages By Harbor Reach-1989 Movements

	Outer Harbor	Lower Cuyahoga River Old River	Middle Cuyahoga River	Upper Cuyahoga River	Total Tonnage
Iron Ore	2,380,542	563,697		5,257,138	8,201,377
Limestone		1,421,308	830,619	415,663	2,667,590
Salt	19,630	944,113			963,743
Cement		505,623			505,623
	2,400,172	2,434,736	830,619	5,672,801	12,338,333

1. Iron Ore- Eight docks were active in the receipt of iron ore in 1989. Two of these docks were located in the Outer Harbor, three on the Old River and lower Cuyahoga, and the remaining three were located on the upper Cuyahoga River.

Receipt of iron ore in the Outer Harbor goes to a transshipment operation that rails the iron ore to inland steel plants for use in their steel production process. Shipments of iron ore to docks located in the upper Cuyahoga River service LTV steel production facilities located adjacent to these docks.

2. Limestone-Twelve docks, some large users, many small users, were active in the limestone trade in 1989. Individual docks are located throughout the harbor on the Old River/lower Cuyahoga (4 docks) the middle Cuyahoga (5 docks) and the upper Cuyahoga River (3 docks).

Limestone vessels utilize all available channels between the main entrance, the Old River and Cuyahoga River. Trips for vessels which transport limestone are distributed 54 percent to the Old River/lower Cuyahoga, 31 percent to the middle Cuyahoga and 15 percent to the upper Cuyahoga. Deferred maintenance would have a much greater impact on those vessels which must navigate

the entire length of the River. This is true since the shoaling rate increases as one moves up the River.

The most active stone docks at the harbor are operated by Ontario Stone. This company's docks, which are located at the mouth of the Cuyahoga River and on the Old River, received more than 36 percent of total harbor limestone receipts. Another active limestone user is LTV Steel which has three limestone docks located in the upper Cuyahoga. These docks received 16 percent of the harbors limestone receipts. The remaining limestone receipts were distributed among six docks located in the lower and middle Cuyahoga River area. These smaller firms are primarily active in the construction aggregate business.

3. Salt.- A large amount of salt shipments originate from a Whiskey Island dock located adjacent to the Old River. This single dock accounts for almost all shipments which leave the harbor. Shipments from this dock totaled 944,113 short tons in 1989. Over 55 percent of the salt shipments were destined for U.S. ports. The remaining 44 percent went to Canadian ports.

4. Cement.- There were two docks that received cement during the 1989 navigation season. Total cement movements equaled 5[illegible],623 tons. Cement is a widely used building material used to [illegible]e concrete. Cement is a vital industrial mineral necessary for the construction sector of the Great lakes economy. Cement markets are regional in scope and usually centered in developing urban areas or locations of major construction projects. The market area of a cement plant can be delineated by the amount of transportation costs that the selling price can absorb.

d. <u>Shoaling Activity.</u>

Transportation costs will increase if existing navigation channel depths decrease as a result of deferred maintenance. Estimates of shoaling rates were developed for the Outer Harbor as well as the Cuyahoga River and the Old River.

Project depths at various locations throughout the Outer Harbor were identified (Figures B1 and B2). Navigation routes taken by vessels to move bulk materials were determined based on origin/destination dock to dock data and commodities shipped/received for the 1989 navigation season. (See Table B2). Finally, the Outer Harbor, the Old River and the Cuyahoga River were divided into twenty-one sections. Shoaling rates were determined for each of these reaches. Unique shoaling rates applied to eleven of these sections. These harbor sections and their respective shoaling rates are presented in Figure B6 and Table B 4.

Based upon the sedimentation study, and the location of various docks that receive/ship bulk commodities, yearly shoaling rates were applied to the various navigation routes and thus commodities. A summary of shoaling rates by harbor reach, and the docks located in each of these reaches, is summarized in Table B4.

Figure B 6 Harbor Section Developed For Shoaling Analysis

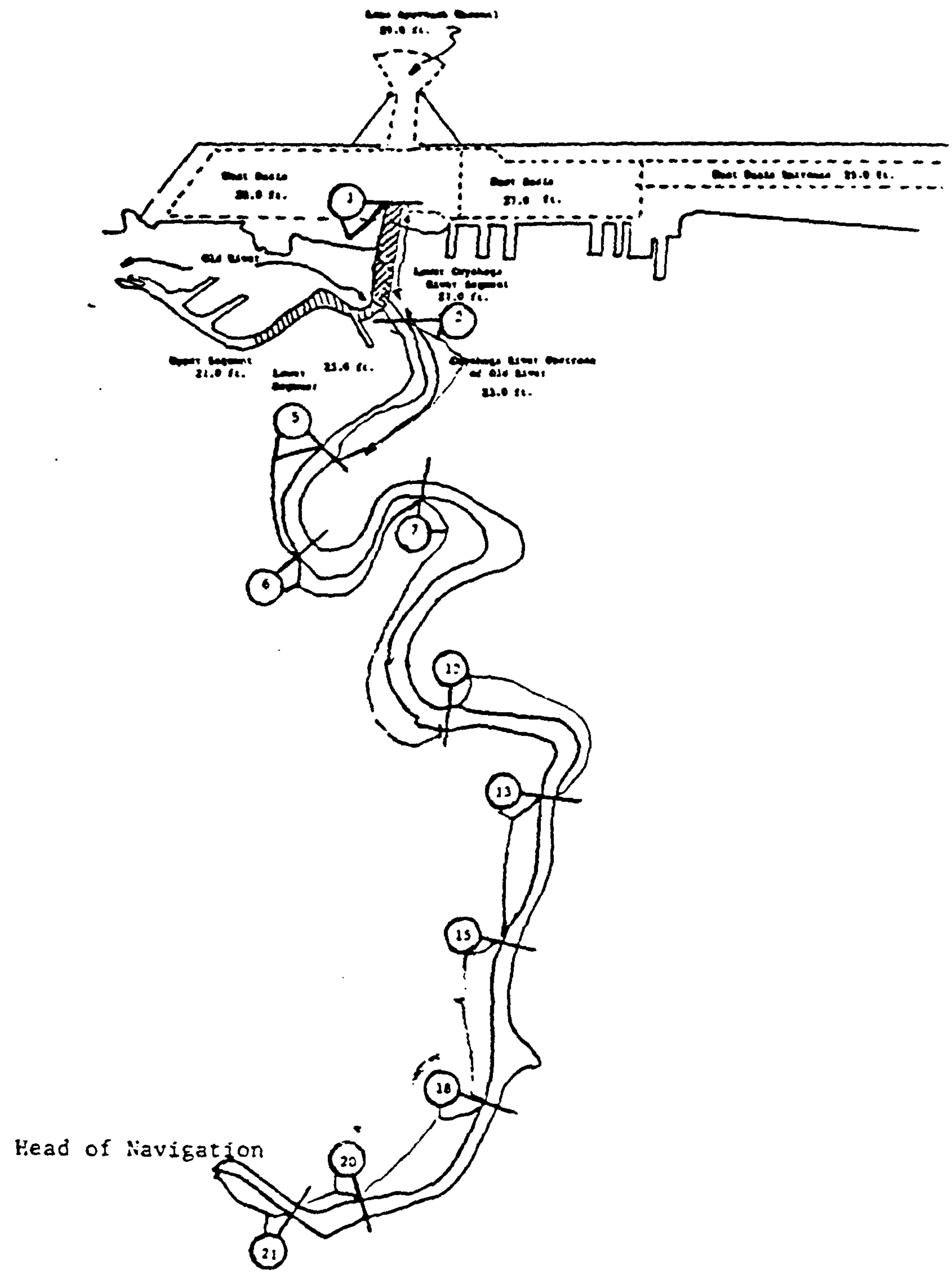


Table B 4-Yearly Shoaling Rate By Cleveland Harbor Reach And Starting Channel Depth

Reach	Yearly Shoaling Rate (feet)	Docks Affected	Starting Channel Depth (Ft)	Channel Depth (LWD)	Commodities Affected(1)
Reach 1	0.37	1-250,673,720	27, 23	541.6	1,2,3,4,
Reach 2	0.33		23	545.6	
Reach 5	0.34		23	545.6	
Reach 6	0.36		23	545.6	
Reach 7	0.39	598	23	545.6	2
Reach 12	0.44	329,580	23	545.6	2
Reach 13	0.53	360	23	545.6	2
Reach 15	0.59	378	23	545.6	2
Reach 18	0.70	410	23	545.6	1,2
Reach 20	1.06	435,440	23	545.6	1,2
Reach 21	2.25		23	545.6	

(1) 1= iron ore, 2= limestone,3= salt, 4= cement

e. Origin/Destination Harbor Traffic Patterns,Iron Ore, Limestone, Salt and Cement.

The Great Lakes water levels fluctuate in the short and long run time frame. Short term fluctuations are due to weather. Strong sustained westerly winds, for example, can "pile" water at the eastern end of Lake Erie. This reduces water surface elevations in Lake Eries' western basin. The water oscillates in Lake Erie until the effect of the weather event has dissipated.

Long term water level fluctuations are generally due to subtle variations of climatic conditions over a period of years. Precipitation significantly above average levels will likely result in sustained increases in water surface elevations over time. However, precipitation significantly below average will likely result in sustained decreases in water elevations. The effect of these variations on water surface elevation for any individual Great lake, or a combination of Great lakes, is that relative navigation channel depths vary. Commercial navigation Carriers effectively manage their vessel loadings to maximize the tonnage carried on each vessel trip. Maximum tonnage carried per vessel trip is a function of the location of the origin harbor, the location of the destination harbor and the available water surface elevations for that trade route. For example, say the trade route is within one lake: iron ore moving from Lorain Harbor, Ohio to Cleveland Harbor, Ohio. The fleet operators load vessels according to that days water surface elevation for Lake Erie levels, thus maximizing vessel efficiency. For example, if for that day water levels for Lake Erie are two feet above datum, fleet operators have two additional feet of draft they can utilize on their movement to Cleveland Harbor, Ohio.

Tables B5, B6, B7 and B8 shows the location, tons and distances from Cleveland Harbor for the origin/destination ports associated with iron ore, limestone, salt and cement movements for 1989. A brief description of these trade routes follows.

1. Iron Ore. There were 8,201,377 tons of iron-ore received at Cleveland Harbor in 1989. U.S. ports accounted for 6,637,636 tons, or 81 percent of the total. The remaining 19 percent was sourced from Canadian Harbors in the lower St. Lawrence River area.

Domestic iron ore sources include harbors along western Lake Superior and Escanaba, Michigan. Ships which load at Lake Superior harbors transit the Soo Locks while ore loaded at Escanaba, Michigan can navigate directly to Cleveland Harbor, Ohio. One advantage of a trade route not dependent upon locks is that vessels are not constrained by the elevation of lock sills and subsequent water depths in a lock. Thus vessels have the ability to fully utilize open lake water levels a greater percentage of the navigation season. All vessels in the iron ore trade were self-unloaders and included class 5, 6, 7, 8 and 10 vessels.

Canadian sourced iron ore comes from Montreal via the St. Lawrence and the Welland Canal via class 7 vessels. Receipts of iron ore from Canadian mines have risen in recent years. Many of the U.S. inland steel plants use Canadian ore for a variety of reasons: partial equity interests in the ore mines, management interests in the Great lakes fleets, contract requirements which are often "take or pay" in nature and favorable currency exchange rates between the two countries. Iron ore sourced from Canadian ports accounted for 19 percent of the iron ore received at Cleveland Harbor in 1989.

The majority of Cleveland Harbors' iron ore tonnage originating in Lake Superior harbors, is either delivered directly to Cleveland or is trans-shipped via Lorain Harbor Ohio. Lorain Harbor,Ohio is located 30 miles west of Cleveland Harbor, Ohio.

The transshipment operation uses class 10 vessels to carry the iron ore pellets from Lake Superior Harbors to Lorain Harbor. This iron ore is reloaded into smaller vessels which proceed down Lake Erie to Cleveland Ohio. Vessels that are designed to maximize carrying capacities on the winding Cuyahoga River are used in this transshipment operation. High Lake Erie water levels can be used advantageously to increase trip carrying capacity and decrease the delivered cost per ton. Authorized channels in the Cuyahoga River are 23 feet lwd, but vessels frequently overdraft by at least 1.5 feet when water levels and channel maintenance on the River are advantageous.

After entering the Outer Harbor, ore ships can proceed directly to a lakefront dock, "lighter at a lower Cuyahoga River transfer dock or navigate directly to the docks using iron ore on the Cuyahoga River. Estimated annual transportation costs have

Table B5- Origin Ports For Iron Ore -1989

Ports	Lake/ Location	Short Tons	Distance (Miles)
A.-Canadian Ports			
Sept Isles	Below Montreal	1,391,144	964
Port Colborne, Ont.	Lake Erie	56,501	160
B. U.S. Ports			
Presque Isle, Mich.	Lake Superior	128,455	598
Superior, Wis	Lake Superior	86,749	831
Two Harbors, Minn	Lake Superior	601,597	809
Lorain Harbor, Oh.	Lake Erie	5,724,868	28
Lake Erie Ont. dredge	Lake Erie	116,096	67
Sault St. Marie	Lake Superior	19,026	438
Taconite Harbor, Minn	Lake Superior	76,941	771
		8,201,337	

Table B6- Origin Ports For Limestone -1989

Ports	Lake/ Location	Short Tons	Distance (Miles)
A. U.S. Ports			
Marblehead Ohio	Lake Erie	553,496	59
Stoneport Mich	Lake Huron	746,946	352
Calcite Mich.	Lake Huron	638,218	380
Port Dolomite, Mich.	Lake Huron	326,199	409
Drummond Isl. Mich.	Lake Huron	69,070	424
Port Inland, Mich.	Lake Michigan	333,631	476
		2,667,590	

Table B7- Destination Ports For Salt -1989

Ports	Lake/ Location	Short Tons	Distance (Miles)
A. Canadian Ports			
St Lawrence River	St. Law. & Below	126,966	534
Port Credit, Ont	Lake Ontario	20,924	
Toronto, Ont.	Lake Ontario	167,001	215
Lake Erie Ont. Dredge	Lake Erie	42,447	67
Thorold Ont.	Welland Canal	41,385	167
Foreign ports		20,928	534

		419,651	
B. U. S. Ports			
Ogdensburg Harbor	St Lawrence River	38,768	408
Toledo Oh.	Lake Erie	46,328	96
Erie Harbor, Pa.	Lake Erie	12,024	102
Dearborn Mi.	Detroit River	134,623	108
Detroit Mi.	Detroit River	28,274	108
Saginaw Mi.	Lake Huron	43,671	345
Muskegon Harbor, Mi.	Lake Michigan	13,504	640
Port Of Chicago	Lake Michigan	50,922	741
Lake Calumet, Ill.	Lake Michigan	60,923	742
Chicago Sanitary	Lake Michigan	13,013	741
Milwaukee, Wi.	Lake Michigan	54,497	676
Sheboygan, Wi.	Lake Michigan	15,926	629
Green Bay, Wis.	Lake Michigan	11,989	615

		524,462	

Table B8- Origin Ports For Cement -1989

Ports	Lake/ Location	Short Tons	Distance (Miles)
A. Canadian Ports			
Bath Ont.	Lake Ontario	94,435	323
B. U. S. Ports			
Bayshore, Mich.	Lake Huron	289,708	326
Charlevoix, Mich.	Lake Michigan	121,480	473

		505,623	

been developed to reflect the range of possible water levels available for these vessels under "without" and "with project" conditions.

2. Limestone.-Limestone receipts have typically originated from domestic ports on Lake Huron. More than 72 percent of all limestone is loaded at Lake Huron ports for delivery via self-unloading ships (Class 5 vessels) to Cleveland Oh. The remaining 28 percent come from Lake Erie sources. Table B3 shows limestone shipments are almost equally distributed between the lower Cuyahoga/Old River and the Middle/Upper Cuyahoga river docks.

No limestone receipts have been recorded at the lakefront. Consequently, all limestone vessels move directly between the origin port and the destination dock. All limestone vessels entering the Old River and Cuyahoga River would have channels with a 23 foot channel depth lwd. Since shoaling is greater on the Upper Cuyahoga, deferred maintenance would have a much greater impact on those vessels which must navigate the entire length of the Cuyahoga River.

3. Salt- All salt shipments from Cleveland harbor originate from a dock located on the upper end of the Old River. The navigation channel in this area is maintained to 21 feet lwd. Vessels engaged in the salt trade ranged from class 3's to class 5's. An overwhelming majority of these vessels have mid summer drafts less than 23 feet.

Canadian destinations accounted for 38 percent of all salt shipments, while U.S. destinations accounted for 62 percent of all salt shipments from Cleveland Harbor. There were 13 different U. S. harbors involved in the salt trade in 1989. Two of these harbors are located on Lake Erie: Toledo Harbor, Ohio and Erie Harbor, Pa. Two other destinations are on the Detroit River (Detroit Michigan and Dearborn Mich.) One destination port is located on Lake Huron(Saginaw Mich). The remaining eight 1989 destination harbors are located on Lake Michigan.

4. Cement- Cement originating from two U.S. ports (Bayshore Mich. and Charlevoix Mich) accounted for over 89 percent of all cement receipts at Cleveland Harbor. Cement carriers are a specialized type of vessel which relies on shoreside equipment to unload the cargo. Only three vessels were active in the U.S. cement trade at Cleveland Harbor in 1989. These vessels ranged in size from a class 2 to a class 4. All of the receiving docks active in the cement trade during 1989 were located on the Old River/Lower Cuyahoga River.

f. Annual Transportation Costs.

Under the "without project" condition, shoaling would continue over the 50 year evaluation period until the Outer Harbor, Cuyahoga River and Old River channels reached equilibrium bottom profile elevations. Annual transportation costs were developed for iron ore for channel depths ranging from 27 to 15 feet below LWD. Annual transportation costs were developed for

limestone, salt and cement for channel depths ranging from 23 to 15 feet below LWD. Current commercial navigation industry practices within the Great Lakes/ St. Lawrence Seaway System are based upon utilization of available water depths and operation of bulk carriers at minimal underkeel clearances. In most instances, vessel operators maximize vessel physical carrying capacity for each trip in light of the available channel depths between specific harbor pairs and each trade route.

Channel depths, water level fluctuations and operating characteristics can vary significantly among the three upper Great Lakes, Lake Erie and Lake Ontario. The physical characteristics of the origin harbors, intermediate connecting channels and destination harbors for iron ore, limestone, salt and cement were examined for the 1989 transportation season. Also included was a determination of vessel sizes used to transport these commodities on the numerous transportation routes. Table B9 presents a summary of the 1989 navigation trade routes for iron ore. It also presents typical vessels, by vessel class, used to move iron ore during the 1989 navigation season. Tables B10, B11 and B12 present similar data except it reflects the limestone, salt and cement trade.

Transportation cost programs (Comnav1, Comnav2) have been developed which utilize channel depths, underkeel clearance, and variable water levels in estimating total transportation costs to move coal and iron ore from and to the Harbor. A range of physical and financial vessel operating characteristics are combined with individual trade routes to derive unit transportation costs by vessel class on a monthly basis. This cost is combined with monthly commodity tonnage movements to estimate transportation costs. Total annual transportation costs represent the summation of all individual months (April-December) of the navigation season.

Comnav 1 computes the transportation cost in dollars per ton for a range of operating drafts for a number of prototype vessels carrying a specific commodity on a specific trade route. Tables B13, B14, B15 and B16 present vessel characteristics for the prototype vessels used in the various trade routes. Table B17 presents the financial characteristics of the prototype vessels used by trade route, for iron ore, limestone, salt and cement. These financial charateristics reflect August 1991 price levels.

The Comnav 1 program first calculates the tonnage capacity of the prototype vessels for various operating drafts. Input needed for the program includes maximum mid summer operating draft, maximum load at mid-summer operating draft, and the immersion factor of the vessel. The immersion factor reflects the number of short tons the vessel can accommodate given one inch of water. The program calculates each individual ships' unique carrying capacity given the vessels draft. Next the program calculates the hourly vessel operating cost using the financial characteristics of the prototype vessels. The fixed cost is based on the construction cost, season length, amortization rate and profit factor. The variable cost is based on wages, supplies, fuel etc., plus an overhead factor.

Table B9- Iron Ore Receipts By Shipment Ports, Fleets-1989

Ports/Vessels	Vessel Class	Short Tons
A.-Canadian Ports		
Sept Isles		1,391,144
Algosoo	7	
Port Colborne, Ont.		56,501
Algosoo	7	
B. U.S. Ports		
Presque Isle, Mich.		128,455
Buffalo	5	
American Republic	5	
Charles E. Wilson	7	
American Mariner	7	
Superior, Wis		86,749
Fred R. White Jr.	5	
Indiana Harbor	10	
Two Harbors, Minn		601,597
John G. Munson	8	
Philip R. Clarke	8	
Presque Isle	10	
Lorain Harbor, Oh.		5,724,868
Richard J. Reiss	5	
Sam Laud	5	
Wolverine	5	
American Republic	5	
Lake Erie Ont. Dredge		116,096
Sam Laud	5	
Sault St. Marie		19,026
Herbert C. Jackson	5	
Taconite Harbor, Mi		76,941
Fred R. White Jr.	5	
		8,201,337

Table B10- Limestone Receipts By Shipment Ports, Fleets-1989

Ports/Vessels	Vessel Class	Short Tons
A. U.S. Ports		
Marblehead Ohio		553,496
Richard J. Reiss	5	
Stoneport Mich		746,946
Wolverine	5	
William R. Roesch	5	
Buffalo	5	
American Republic	5	
Calcite Mich.		638,218
Paul Thayer	5	
American Republic	5	
Calcite II	5	
Buffalo	5	
Port Dolomite, Mich.		326,199
J. Burton Ayers	5	
Calcite II	5	
Buffalo	5	
Drummond Isl. Mich.		69,070
J. Burton Ayers	5	
Port Inland, Mich.		333,631
Wolverine	5	
Buffalo	5	
		2,667,590

Table B11- Salt Shipments By Receiving Port, Fleet:-1989

Ports/Vessels	Vessel Class	Short Tons
A. Canadian Ports		
St Lawrence River		126,966
Myron C. Taylor	5	
Port Credit, Ont		20,924
Myron C. Taylor	5	
Toronto, Ont.		167,001
Myron C. Taylor	5	
Lake Erie Ont. Dredge		42,447
Myron C. Taylor	5	
Thorold Ont.		41,385
Myron C. Taylor	5	
Foreign ports		20,928
Myron C. Taylor	5	

		419,651
B. U. S. Ports		
Ogdensburg Harbor		38,768
Calcite II	5	
Toledo Oh.		46,328
Nicolet	3	
Sam Laud	5	
Erie Harbor, Pa.		12,024
Nicolet	5	
Dearborn Mi.		134,623
Nicolet	3	
Sam Laud	5	
Detroit Mi.		28,274
Nicolet	3	
Sam Laud	5	
Saginaw Mi.		43,671
Nicolet	3	
Sam Laud	5	
Muskegon Harbor, Mi.		13,504
Calcite II	5	
Port Of Chicago		50,922
Irvin L. Clymer	4	
Calcite II	5	
Lake Calumet, Ill.		60,923
Irvin L. Clymer	4	
Chicago Sanitary		13,013
Irvin L. Clymer	4	
Myron C. Taylor	5	
Milwaukee, Wi.		54,497
Irvin L. Clymer	4	
Calcite II	5	
Sheboygan, Wi.		15,926
Irvin L. Clymer	4	
Green Bay, Wis.		11,989
Irvin L. Clymer	4	

		524,462

Table B12- Cement Receipts By Shipment Ports, Fleets-1989

Ports/Vessels	Vessel Class	Short Tons
A. Canadian Ports		
Bath Ont.		94,435
Sam Laud	5	
B. U. S. Ports		
Bayshore, Mich.		289,708
Paul H. Townsend	2	
J.A.W. Iglehart	3	
Charlevoix, Mich.		121,480
Paul H. Townsend	2	
Medusa Challenger	4	

		505,623

Table B17.- Financial Characteristics Of Prototype Vessels

TABLE B 17 - ANNUAL VESSEL OPERATING COSTS

VESSEL CLASS	2	3	4	5	6	7	8	10
CONSTRUCTION ($M) (1)	$27	$29	$32	$34	$40	$43	$50	$77
AMORTIZATION RATE	0.08884	0.08884	0.08884	0.08884	0.08884	0.08884	0.08884	0.08884
ANNUAL FIXED COST/YE	$2,398,680	$2,576,360	$2,842,880	$3,020,560	$3,553,600	$3,820,120	$4,442,000	$6,840,680
SEASON LENGTH (DAYS)	275	275	275	275	275	275	275	275
FIXED COST/DAY($)	$8,722	$9,369	$10,338	$10,984	$12,922	$13,891	$16,153	$24,875
PROFIT FACTOR	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
TOTAL DAILY FIXED COS	$10,031	$10,774	$11,888	$12,631	$14,861	$15,975	$18,576	$28,606
DAILY VARIABLE COST($)	$12,722	$13,803	$15,869	$16,255	$16,972	$17,238	$18,084	$22,363
OVERHEAD FACTOR	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12
TOTAL DAILY VARIABLE C	$14,249	$15,459	$17,773	$18,206	$19,009	$19,307	$20,254	$25,047
DAILY VESSEL COST ($)	$24,279	$26,233	$29,662	$30,837	$33,869	$35,282	$38,830	$53,653

(1) Construction Costs Reflect 1991 Price levels
(2) Daily Variable Operating Costs From Marad.

Table B 13- Iron Ore Trade Routes And Prototype Vessel Characteristics, Cleveland Harbor Ohio.

Table B 13- Iron Ore Trade Route And Prototype Vessel Characteristics, Cleveland Harbor , Ohio

TRADE ROUTE/ VESSEL PROTOTYPE	YEAR BUILT	VESSEL CLASS	VESSEL LENGTH (FEET)	VESSEL BEAM (FEET)	MID SUMMER ESSEL DRAFT (FEET)	MID SUMMER VESSEL CAPCTY NET TONS	IMRS FCTR NET TONS PER INCH	HARBOR MANEUV TIME HOURS ORIG	DES	LOADING RATE SHORT TONS PER HOUR	UN LOADING RATE: SHORT TONS PER HOUR	AVERAGE VESSEL SPEED (MPH)	TIME IN LOCK (HRS	LOCK DELAY (HRS)
CANADIAN IRON ORE														
SEPT ISLES														
ALGOSOO	1974	7	730.0	75.0	29.0	35,100	133	1	1	3,000	5,000	12	12.0	6.0
DOMESTIC IRON ORE														
PRESQUE ISLE, MICH.														
BUFFALO	1978	5	634.8	68.0	28.0	26,700	106	1	1	3,100	7,400	14	1.5	0.5
AMERICAN REPUBLIC	1981	5	634.9	68.0	28.3	26,000	108	1	1	3,100	7,400	14	1.5	0.5
CHARLES E. WILSON	1973	6	680.0	78.0	30.6	37,900	131	1	1	3,100	6,700	14	1.5	0.5
AMERICAN MARINER	1980	7	730.0	78.0	30.9	41,700	141	1	1	3,100	7,400	14	2.0	0.5
SUPERIOR, WIS														
FRED R. WHITE JR.	1979	5	636.0	68.0	27.9	26,700	106	1	1	3,200	7,400	14	1.5	0.5
INDIANA HARBOR	1979	10	1000.0	105.0	34.0	88,300	265	1	1	3,200	11,200	14	2.8	0.5
TWO HARBORS, MINN														
JOHN G. MUNSON	1952	8	768.3	72.0	27.3	28,900	130	1	1	3,200	5,600	14	2.0	0.5
PHILIP R. CLARKE	1952	8	767.0	70.0	27.0	29,700	127	1	1	3,200	6,700	14	2.0	0.5
PRESQUE ISLE	1973	10	1000.0	104.7	28.6	64,400	239	1	1	3,200	11,200	14	2.8	0.5
LORAIN HARBOR, OH														
RICHARD J. REISS	1943	5	620.6	60.3	24.6	16,700	85	1	1	5,000	5,600	14	1.5	0.5
SAM LAUD	1975	5	634.8	68.0	28.0	26,700	106	1	1	5,000	7,400	14	1.5	0.5
WOLVERINE	1974	5	630.0	68.0	26.0	22,000	102	1	1	5,000	7,400	14	1.5	0.5
AMERICAN REPUBLIC	1981	5	634.9	68.0	28.3	26,000	108	1	1	5,000	7,400	14	1.5	0.5
SAULT ST. MARIE														
HERBERT C. JACKSON	1959	6	690.2	75.0	27.7	27,800	122	1	1	3,200	6,700	14	1.5	0.5
TACONITE HARBOR, MINN														
FRED R. WHITE JR.	1979	5	636.0	68.0	27.9	26,700	106	1	1	3,200	7,400	14	1.5	0.5

Table B 14- Limestone Trade Routes And Prototype Vessel Characteristics, Cleveland Harbor Ohio.

Table B 14- Limestone Trade Route And Prototype Vessel Characteristics, Cleveland Harbor, Ohio

TRADE ROUTE/ VESSEL PROTOTYPE	YEAR BUILT	VESSEL CLASS	VESSEL LENGTH (FEET)	VESSEL BEAM (FEET)	MID SUMMER VESSEL DRAFT (FEET)	MID SUMMER VESSEL CAPCTY NET TONS	IMRS FCTR NET TONS PER INCH	HARBOR MANEUV TIME HOURS ORIG	DEST	LOADING RATE SHORT TONS PER HOUR	UN LOADING RATE: SHORT TONS PER HOUR	AVERAGE VESSEL SPEED (MPH)	TIME IN LOCK (HRS)	LOCK DELAY (HRS)
STONEPORT MICH.														
WOLVERINE	1974	5	630.0	68.0	26.0	22,000	102	1	1	1,800	7,400	14	0.0	0.0
WILLIAM R. ROESCH	1973	5	630.0	68.0	26.0	22,000	101	1	2	1,800	7,400	14	0.0	0.0
BUFFALO	1978	5	634.8	68.0	28.0	26,700	106	1	2	1,800	7,400	14	0.0	0.0
AMERICAN REPUBLIC	1981	5	634.9	68.0	28.3	26,000	108	1	3	1,800	7,400	14	0.0	0.0
PORT INLAND, MICH														
WOLVERINE	1974	5	630.0	68.0	26.0	22,000	102	1	1	1,800	7,400	14	0.0	0.0
BUFFALO	1978	5	634.8	68.0	28.0	26,700	106	1	2	1,800	7,400	14	0.0	0.0
CALCITE, MICH.														
PAUL THAYER	1973	5	630.0	68.0	26.0	22,000	103	1	1	1,700	7,400	14	0.0	0.0
AMERICAN REPUBLIC	1981	5	634.9	68.0	28.3	26,000	108	1	3	1,700	7,400	14	0.0	0.0
CALCITE II	1973	5	604.9	60.0	22.3	14,600	82	1	2	1,700	7,400	14	0.0	0.0
BUFFALO	1978	5	634.8	68.0	28.0	26,700	106	1	3	1,700	7,400	14	0.0	0.0
PORT DOLOMITE, MICH.														
J BURTON AYERS	1974	5	620.0	60.0	25.5	17,400	86	1	1	3,200	7,400	14	0.0	0.0
CALCITE II	1973	5	604.9	60.0	22.3	14,600	82	1	2	3,200	7,400	14	0.0	0.0
BUFFALO	1978	5	634.8	68.0	28.0	26,700	106	1	2	3,200	7,400	14	0.0	0.0
DRUMMOND ISLAND, MICH.														
J BURTON AYERS	1974	5	620.0	60.0	25.5	17,400	86	1	1	2,000	7,400	14	0.0	0.0
MARBLEHEAD, OHIO														
RICHARD J. REISS	1943	5	620.6	60.3	24.6	16,700	85	1	1	1,500	5,600	14	0.0	0.0

Table B 15- Salt Trade Routes And Prototype Vessel Characteristics, Cleveland Harbor Ohio.

Table B 15- Salt Trade Route And Prototype Vessel Characteristics, Cleveland Harbor, Ohio														
TRADE ROUTE/ VESSEL PROTOTYPE	YEAR BUILT	VESSEL CLASS	VESSEL LENGTH (FEET)	VESSEL BEAM (FEET)	MID SUMMER VESSEL DRAFT (FEET)	MID SUMMER VESSEL CAPCTY NET TONS	IMRS FCTR NET TONS PER INCH	HARBOR MANEUV TIME HOURS ORIG	DEST	LOADING RATE SHORT TONS PER HOUR	UN LOADING RATE SHORT TONS PER HOUR	AVERAGE VESSEL SPEED (MPH)	TIME IN LOCK (HRS)	LOCK DELAY (HRS)
OGDENSBURG HARBOR, N.Y.														
CALCITE II	1973	5	604.9	60.0	22.3	14,600	82	1	1		7,400	12	8.0	6.0
TOLEDO, OHIO														
NICOLET	1905	3	533.0	60.0	22.0	12,500	76	1	1		5,600	14	0.0	0.0
SAM LAUD	1975	5	634.8	68.0	28.0	26,700	106	1	1		7,400	14	0.0	0.0
ERIE HARBOR, PA													0.0	0.0
NICOLET	1905	3	533.0	60.0	22.0	12,500	76	1	1		5,600	14	0.0	0.0
DEARBORNE, MICH														
NICOLET	1905	3	533.0	60.0	22.0	12,500	76	1	1		5,600	14	0.0	0.0
SAM LAUD	1975	5	634.8	68.0	28.0	26,700	106	1	1		7,400	14	0.0	0.0
DETROIT MICH														
NICOLET	1905	3	533.0	60.0	22.0	12,500	76	1	1		5,600	14	0.0	0.0
SAM LAUD	1975	5	634.8	68.0	28.0	26,700	106	1	1		7,400	14	0.0	0.0
SAGINAW, MICH														
NICOLET	1905	3	533.0	60.0	22.0	12,500	76	1	1		5,600	14	0.0	0.0
SAM LAUD	1975	5	634.8	68.0	28.0	26,700	106	1	1		7,400	14	0.0	0.0
MUSKEGON HARBOR, MICH														
CALCITE II	1973	5	604.9	60.0	22.3	14,600	82	1	1		7,400	14	0.0	0.0
PORT OF CHICAGO														
IRVIN L. CLYMER	1917	4	552.0	60.0	22.6	13,600	77	1	1		6,500	14	0.0	0.0
CALCITE II	1973	5	604.9	60.0	22.3	14,600	82	1	1		7,400	14	0.0	0.0
LAKE CALUMET, IL														
IRVIN L. CLYMER	1917	4	552.0	60.0	22.6	13,600	77	1	1		6,500	14	0.0	0.0
CHICAGO SANITARY														
IRVIN L. CLYMER	1917	4	552.0	60.0	22.6	13,600	77	1	1		6,500	14	0.0	0.0
MYRON C. TAYLOR	1929	5	603.9	60.0	22.2	14,300	82	1	1		6,500	14	0.0	0.0
MILWAUKEE, WIS														
IRVIN L. CLYMER	1917	4	552.0	60.0	22.6	13,600	77	1	1		6,500	14	0.0	0.0
CALCITE II	1973	5	604.9	60.0	22.3	14,600	82	1	1		7,400	14	0.0	0.0
SHEBOYGAN, WIS														
IRVIN L. CLYMER	1917	4	552.0	60.0	22.6	13,600	77	1	1		6,500	14	0.0	0.0
GREENBAY, WIS														
IRVIN L. CLYMER	1917	4	552.0	60.0	22.6	13,600	77	1	1		6,500	14	0.0	0.0

Table B 16- Cement Trade Routes And Prototype Vessel Characteristics, Cleveland Harbor Ohio.

Table B 16- Cement Trade Route And Prototype Vessel Characteristics, Cleveland Harbor, Ohio

TRADE ROUTE/ VESSEL PROTOTYPE	YEAR BUILT	VESSEL CLASS	VESSEL LENGTH (FEET)	VESSEL BEAM (FEET)	MID SUMMER VESSEL DRAFT (FEET)	MID SUMMER VESSEL CAPCTY NET TONS	IMRS FCTR NET TONS PER INCH	HARBOR MANEUV TIME HOURS ORIG	DEST	LOADING RATE SHORT TONS PER HOUR	UN LOADING RATE: SHORT TONS PER HOUR	AVERAGE VESSEL SPEED (MPH)	TIME IN LOCK (HRS	LOCK DELAY (HRS)
RECEIPTS-CANADIAN & FOREIGN														
BATH, ONTARIO														
SAM LAUD	1975	5	634.8	68.0	28.0	26,700	106	1	1	900	7,400	12	12.0	6.0
RECEIPTS-DOMESTIC														
BAYSHORE, MICH.														
PAUL H. TOWNSEND	1945	2	447.0	50.0	22.1	8,800	45	1	1	2,500	1,000	14	0.0	0.0
J.A.W. IGLEHART	1936	3	501.6	68.3	27.3	14,800	75	1	1	2,500	1,000	14	0.0	0.0
CHARLEVOIX, MICH.														
PAUL H. TOWNSEND	1945	2	447.0	50.0	22.1	8,800	45	1	1	1,400	1,000	14	0.0	0.0
MEDUSA CHALLENGER	1906	4	552.1	56.0	21.8	11,500	69	1	1	1,400	1,000	14	0.0	0.0

Comnav 1 then calculates the total transit time by using physical characteristics of the vessel plus the sailing distance between the origin/destination harbors. The total transit time at a given operating draft is multiplied by the hourly vessel operating cost to yield the transportation cost. This cost is divided by the number of tons carried at a given operating draft to arrive at the transportation cost per ton.

The second program, Comnav2, combines information on depths, drafts, and underkeel clearances for the origin harbor, destination harbor and connecting channels. It also incorporates stage-duration-frequency curves to derive a weighted annual vessel operating draft. This draft is identified with the unit-cost per ton matrix developed previously, and multiplied by the tonnage allocation for that month, vessel and forecast interval to calculate transportation costs.

Comnav 2 uses historical lake level elevations and stage frequencies for a variety of nodes (Duluth, Vidal Shoals, Livingstone Channel, Michigan/Huron, Ashtabula Harbor) to establish draft frequencies. Each point within the trade route is uniquely represented within the transportation cost model. Stage-duration frequency curves are transformed, after identification of an average channel bottom elevation and a representative underkeel clearance, into draft-frequency relationships.

For example, all locations below Lake Superior are combined into a composite draft-frequency curve and each point of the origin harbor draft-frequency curve is related to a range of points (ie. drafts) along the composite draft frequency curve. The program then uses the draft-frequencies and the Coast Guard load limits to establish the effective draft by determining the constraining points on the system by month. The program then uses the effective draft to read the tonnage capacity off the draft tonnage capacity curve. It also uses the effective draft to read the cost per ton off the draft/cost per ton matrix Table developed by Comnav1. The cost per ton is then multiplied by the monthly tonnage allocated by vessel size, and aggregated by month to arrive at total annual transportation costs.

Transportation costs were derived by trade route, for a specific fleet mix. Channel depths along the trade route at various critical points (See Figure B7) were used in conjunction with channel depths at the origin and destination ports. A range of alternative channel depths were identified and expected annual transportation costs were calculated for each major commodity flow and dock location for iron ore, limestone, salt and cement. Tables B 18, B 19, B 20 and B 21 provide annual transportation costs by channel depth for the iron ore, limestone, salt and cement trade routes.

Table B 18-Transportation Costs By Harbor Location By Channel Depth- Iron Ore

A.- OUTER HARBOR:

MAINTAINED CHANNEL DEPTH (FEET)	ORIGIN HARBORS: SUPERIOR HARBOR ($000)	PRESQUE ISLE ($000)	TWO HARBORS ($000)	CANADIAN ORE ($000)	TWO HARBORS ($000)	IRON ORE TRANS COSTS OUTER HARBOR ($000)
27.0	475.0	508.0	2113.0	14070.0	941.0	18107.0
26.0	479.0	512.0	2127.0	14462.0	947.0	18527.0
25.0	489.0	522.0	2170.0	15080.0	964.0	19225.0
24.0	508.0	541.0	2252.0	15838.0	997.0	20136.0
23.0	534.0	567.0	2364.0	16707.0	1042.0	21214.0
22.0	564.0	596.0	2496.0	17085.0	1094.0	22435.0
21.0	598.0	631.0	2650.0	18797.0	1154.0	23830.0
20.0	638.0	670.0	2826.0	20074.0	1222.0	25430.0
19.0	684.0	715.0	3033.0	21540.0	1301.0	27273.0
18.0	737.0	767.0	3278.0	23262.0	1393.0	29437.0
17.0	801.0	830.0	3572.0	25304.0	1500.0	32007.0

B.- LOWER RIVER DOCKS

MAINTAINED CHANNEL DEPTH (FEET)	ORIGIN HARBORS: LORAIN HARBOR ($000)	SAULT ST MARIE ($000)	LORAIN HARBOR ($000)	IRON ORE TRANSPORTATION COSTS LOWER RIVER DOCKS ($000)
23.0	14.0	82.0	435.0	531.0
22.0	14.0	83.0	450.0	547.0
21.0	14.0	86.0	466.0	566.0
20.0	15.0	90.0	487.0	592.0
19.0	16.0	97.0	508.0	621.0
18.0	16.0	105.0	532.0	653.0
17.0	17.0	116.0	565.0	698.0
16.0	19.0	128.0	604.0	751.0
15.0	20.0	145.0	653.0	818.0

Table B 18-Iron Ore-CONTINUED

C. UPPER RIVER DOCKS WITH .7 FEET OF SHOALING PER YEAR-

MAINTAINED CHANNEL DEPTH (FEET)	ORIGIN HARBOR LORAIN HARBOR ($000)	UPPER RIVER TRANS COSTS ($000)
23.0	326.0	326.0
22.0	339.0	339.0
21.0	353.0	353.0
20.0	368.0	368.0
19.0	386.0	386.0
18.0	409.0	409.0
17.0	436.0	436.0
16.0	470.0	470.0
15.0	511.0	511.0

D.-UPPER RIVER DOCKS WITH 1.06 FEET OF SHOALING PER YEAR

	ORIGIN HARBORS		
MAINTAINED CHANNEL DEPTH (FEET)	TACONITE HARBOR ($000)	LORAIN HARBOR ($000)	UPRIVER TRANS COSTS ($000)
23.0	579.0	4612.0	5191.0
22.0	613.0	4786.0	5399.0
21.0	651.0	4983.0	5634.0
20.0	695.0	5210.0	5905.0
19.0	745.0	5437.0	6182.0
18.0	805.0	5802.0	6607.0
17.0	875.0	6188.0	7063.0
16.0	959.0	6672.0	7631.0
15.0	1063.0	7251.0	8314.0

Table B 19-Transportation Costs By Harbor Location By Channel Depth- Limestone

1. LOWER RIVER DOCKS- WITH .37 FEET OF SHOALING PER YEAR

MAINTAINED CHANNEL DEPTH (FEET)	STONEPORT PORT INLAND CALCITE PRT DOLOMITE DRMD IS. ($000)	MRBLHEAD ($000)	TRANS COSTS LOWER RIVER ($000)
TONS	(1,177,193)	(244,215)	
	ORIGIN	PORTS	
23.0	5,771	491	6,262.0
22.0	6,086	495	6,581.0
21.0	6,466	505	6,971.0
20.0	6,912	521	7,433.0
19.0	7,432	543	7,975.0
18.0	8,057	570	8,627.0
17.0	8,815	601	9,416.0
16.0	9,754	640	10,394.0
15.0	10,946	691	11,637.0

2. MIDDLE RIVER DOCKS- WITH .44 FEET OF SHOALING PER YEAR

MAINTAINED CHANNEL DEPTH (FEET)	MRBLHEAD ($000)	STONEPORT CALCITE ($000)	TRANS COSTS MIDDLE RIVER ($000)
TONS	281,019	76,724	
	ORIGIN	PORTS	
23.0	572.0	347.0	919.0
22.0	579.0	366.0	945.0
21.0	592.0	387.0	979.0
20.0	613.0	412.0	1,025.0
19.0	640.0	441.0	1,081.0
18.0	674.0	476.0	1,150.0
17.0	713.0	518.0	1,231.0
16.0	763.0	570.0	1,333.0
15.0	827.0	635.0	1,462.0

Table B 19-Limestone, Continued

3. MIDDLE RIVER - DOCKS WITH .53 FEET OF SHOALING PER YEAR

TONS 44,759

MAINTAINED CHANNEL DEPTH	ORIGIN PORTS CALCITE PORT DOLOMITE ($000)	TRANS COSTS MIDDLE RIVER ($000)
23.0	279.0	279.0
22.0	280.0	280.0
21.0	284.0	284.0
20.0	295.0	295.0
19.0	313.0	313.0
18.0	337.0	337.0
17.0	366.0	366.0
16.0	402.0	402.0
15.0	446.0	446.0

4. MIDDLE RIVER - DOCKS WITH .59 FEET OF SHOALING PER YEAR

TONS 28,362

MAINTAINED CHANNEL DEPTH	MARBLEHEAD ($000)	TRANS COSTS MIDDLE RIVER ($000)
23.0	58.0	58.0
22.0	58.0	58.0
21.0	60.0	60.0
20.0	62.0	62.0
19.0	65.0	65.0
18.0	68.0	68.0
17.0	72.0	72.0
16.0	77.0	77.0
15.0	83.0	83.0

Table B 19-Limestone, Continued

5. MIDDLE RIVER - DOCKS WITH .39 FEET OF SHOALING PER YEAR

TONS 399,755

MAINTAINED CHANNEL DEPTH (FEET)	STONEPORT PORT DOLOMITE PORT INLAND ($000)	TRANS COSTS MIDDLE RIVER ($000)
23.0	1,965.0	1,965.0
22.0	2,048.0	2,048.0
21.0	2,156.0	2,156.0
20.0	2,285.0	2,285.0
19.0	2,436.0	2,436.0
18.0	2,616.0	2,616.0
17.0	2,827.0	2,827.0
16.0	3,082.0	3,082.0
15.0	3,395.0	3,395.0

6. UPPER RIVER DOCKS WITH .7 FEET OF SHOALING PER YEAR

TONS 49,584

MAINTAINED CHANNEL DEPTH (FEET)	STONEPORT CALCITE DRMND IS ($000)
23.0	236.0
22.0	248.0
21.0	263.0
20.0	280.0
19.0	300.0
18.0	324.0
17.0	353.0
16.0	389.0
15.0	433.0

7. UPPER RIVER DOCKS WITH 1.06 FEET OF SHOALING PER YEAR

TONS 366,C

MAINTAINED CHANNEL DEPTH (FEET)	STONEPORT & CALCITE ($000)	UPRIVER TRANS COSTS ($000)
23.0	1,641.0	1,641.0
22 0	1,727.0	1,727.0
21.0	1,828.0	1,828.0
20.0	1,944.0	1,944.0
19.0	2,079.0	2,079.0
18.0	2,240.0	2,240.0
17.0	2,434.0	2,434.0
16.0	2,672.0	2,672.0
15.0	2,971.0	2,971.0

Table B 20-Transportation Costs By Harbor Location By Channel Depth- Canadian Salt

1. OLD RIVER DOCK WITH .37 FEET OF SHOALING PER YEAR- CANADIAN LAKE ERIE PORTS

MAINTAINED CHANNEL DEPTH (FEET)	CANADIAN LAKE ERIE RECEIVING PORTS ($000)	TRANS COSTS OLD RIVER ($000)
21.0	91	91.0
20.0	93	93.0
19.0	96	96.0
18.0	100	100.0
17.0	104	104.0
16.0	110	110.0
15.0	117	117.0

2. OLD RIVER DOCK-.37 FEET SHOALING PER YEAR-CANADIAN LAKE ONTARIO PORTS

MAINTAINED CHANNEL DEPTH	CANADIAN LAKE ONTARIO RECEIVING PORTS ($000)	TRANS COSTS OLD RIVER ($000)
21.0	1,299	1,299.0
20.0	1,341	1,341.0
19.0	1,413	1,413.0
18.0	1,512	1,512.0
17.0	1,633	1,633.0
16.0	1,781	1,781.0
15.0	1,966	1,966.0

3. OLD RIVER DOCK-.37 FEET SHOALING PER YEAR-CANADIAN ST. LAWRENCE

MAINTAINED CHANNEL DEPTH (FEET)	CANADIAN ST LAWRENCE RECEIVING PORTS ($000)	TRANS COSTS OLD RIVER ($000)
21.0	1,418	1,418.0
20.0	1,470	1,470.0
19.0	1,558	1,558.0
18.0	1,679	1,679.0
17.0	1,827	1,827.0
16.0	2,008	2,008.0
15.0	2,233	2,233.0

Table B 20-Transportation Costs By Channel Depth-continued

4. OLD RIVER DOCK- .37 FEET SHOALING PER YEAR- TO U.S. LAKE MICHIGAN PORTS

MUSKEGON, PRT OF CHICAGO, LAKE CALUMET, CHICAGO SANITARY, MILWAUKEE WIS., SHEBOYGAN, GREENBAY

MAINTAINED CHANNEL DEPTH	LAKE MICHIGAN RECEIVING PORTS ($000)	TRANS COSTS OLD RIVER ($000)
21.0	1,879	1,879.0
20.0	1,931	1,931.0
19.0	2,035	2,035.0
18.0	2,179	2,179.0
17.0	2,356	2,356.0
16.0	2,572	2,572.0
15.0	2,837	2,837.0

5. OLD RIVER DOCK-.37 FEET SHOALING PER YEAR-TO U.S. LAKE HURON PORTS

MAINTAINED CHANNEL DEPTH (FEET)	LAKE HURON RECEIVING PORTS ($000)	TRANS COSTS OLD RIVER ($000)
21.0	178	178.0
20.0	183	183.0
19.0	191	191.0
18.0	202	202.0
17.0	216	216.0
16.0	233	233.0
15.0	253	253.0

6. OLD RIVER DOCK- .37 FEET SHOALING PER YEAR- TO U.S. PORTS ON THE DETROIT RIVER

MAINTAINED CHANNEL DEPTH (FEET)	RECEIVING PORTS ON THE DETROIT RIVER ($000)	TRANS COSTS OLD RIVER ($000)
21.0	360	360.0
20.0	367	367.0
19.0	378	378.0
18.0	394	394.0
17.0	412	412.0
16.0	435	435.0
15.0	463	463.0

Table B 20-Transportation Costs By Channel Depth-continued

7. OLD RIVER DOCK- .37 FEET SHOALING PER YEAR- TO U.S. LAKE ERIE PORTS- TOLEDO, ERIE HARBOR

	RECEIVING PORTS	
CHANNEL DEPTH	TOLEDO ERIE HARBOR ($000)	TRANS COSTS OLD RIVER ($000)
21.0	125	125.0
20.0	128	128.0
19.0	132	132.0
18.0	138	138.0
17.0	145	145.0
16.0	153	153.0
15.0	164	164.0

8. OLD RIVER DOCK- .37 FEET SHOALING PER YEAR- TO U.S. PORTS ON THE ST. LAWRENCE

CHANNEL DEPTH	SALT DOCK ($000)	TRANS COSTS OLD RIVER ($000)
21.0	309	309.0
20.0	321	321.0
19.0	339	339.0
18.0	364	364.0
17.0	395	395.0
16.0	432	432.0
15.0	478	478.0

Table B 21-Transportation Costs By Channel Depth- Cement

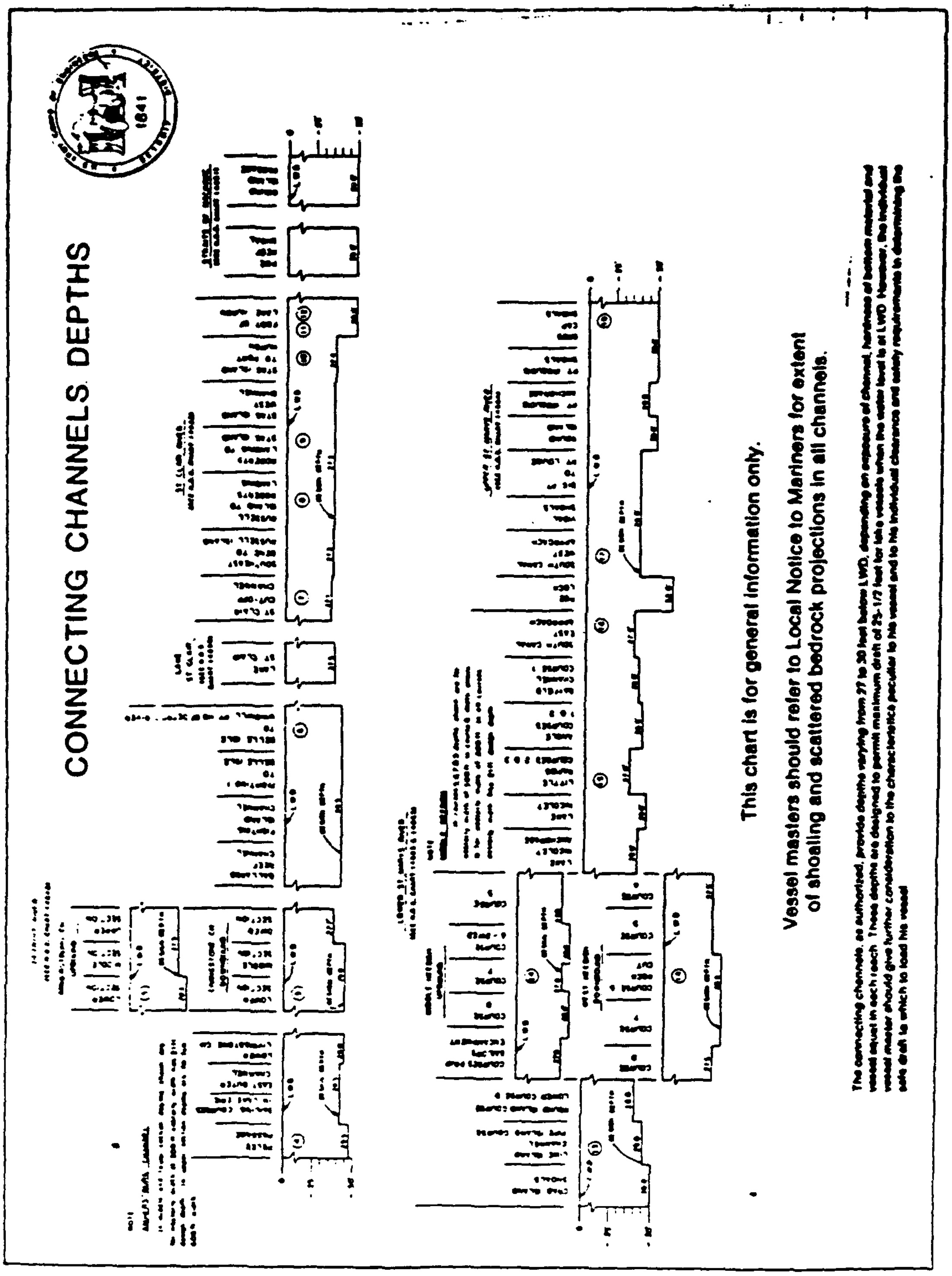
1. OLD RIVER/CUYAHOGA RIVER DOCKS- .37 FEET SHOALING PER YEAR - LAKES MICH/HURON SHIPMENT PORTS

TONS	411,188	
MAINTAINED CHANNEL DEPTH	LAKES MICHIGAN & HURON ($000)	TOTAL TRANS COSTS LOWER RIVER ($000)
23.0	2,525	2,525.0
22.0	2,556	2,556.0
21.0	2,620	2,620.0
20.0	2,733	2,733.0
19.0	2,902	2,902.0
18.0	3,123	3,123.0
17.0	3,400	3,400.0
16.0	3,754	3,754.0
15.0	4,224	4,224.0

2. OLD RIVER/CUYAHOGA RIVER DOCKS- .37 FEET SHOALING PER YEAR - CANADIAN LAKE ONTARIO SHIPMENT PORTS

TONS	94,435	
CHANNEL DEPTH	LAKE ONTARIO ($000)	TRANS COSTS LOWER RIVER ($000)
23.0	488	488.0
22.0	510	510.0
21.0	534	534.0
20.0	562	562.0
19.0	594	594.0
18.0	632	632.0
17.0	677	677.0
16.0	731	731.0
15.0	797	797.0

Figure 7. Connecting Channels And St. Lawrence River Water Levels And Depths



g. Time Stream Of Annual Transportation Costs: Iron Ore, Limestone, Salt And Cement.

The data in Tables B 18,B 19, B 20 and B 21 were used in conjunction with the location of the docks that receive/ship any of the four major bulk commodities as well as the shoaling rates associated with the navigation channels leading to these docks. The combination of this data was used to identify the point in time when these transportation costs would accrue to each commodity based on that commodities dock location. The navigation channel servicing Outer Harbor iron ore movements was assumed to shoal at .37 feet per year. The navigation channel servicing upriver iron ore and limestone movements had a shoaling rate that varied from .37 feet per year to 1.06 feet per year. The navigation channel servicing salt movements had a shoaling rate of .33 feet per year. The navigation channel servicing cement movements had a shoaling rate of .37 feet per year. The time stream of annual transportation costs under the "Without" and "With Project" conditions for iron ore, limestone, salt and cement are presented in Tables B22, B23, B24 and B25.

B3. BENEFIT EVALUATION

a. Introduction.

The major benefit category for this project is transportation costs avoided. The benefit evaluation focused on the impact on transportation costs associated with iron ore, limestone, salt and cement under "without" and "with project" conditions. Transportation costs associated with sand and gravel are also impacted. However, the impact on the transportation costs associated with this commodity was not evaluated at this time. The derivation of transportation costs avoided associated with these four major bulk commodities follows.

b. Average Annual Transportation Costs Avoided

The time stream of annual transportation costs presented in Tables B22, B23, B24 and B25 were converted to present worth values given an 8.50 percent annual interest rate. These present worth values were then converted to average annual transportation costs using a 50 year evaluation period and an 8.50 percent annual interest rate. This data is presented in Tables B22, B23, B24 and B25 for iron ore, limestone, salt and cement under "without" and "with project" conditions.

Table B 22A-Annual Transportation Costs - Outer Harbor Iron Ore

WITHOUT PROJECT CONDITION ($000)

PROJECT YEAR	LWD CHANNEL DEPTH	OUTER HARBOR TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE
1	27.0	18107.0	0.92166	16688.5
2	26.6	18275.0	0.84946	15523.8
3	26.3	18401.0	0.78291	14406.3
4	25.9	18596.8	0.72157	13419.0
5	25.5	18876.0	0.66505	12553.4
6	25.1	19155.2	0.61295	11741.1
7	24.8	19407.2	0.56493	10963.6
8	24.4	19771.6	0.52067	10294.5
9	24.0	20136.0	0.47988	9662.9
10	23.7	20459.4	0.44229	9048.9
11	23.3	20890.6	0.40764	8515.8
12	22.9	21336.1	0.37570	8016.0
13	22.6	21702.4	0.34627	7514.9
14	22.2	22190.8	0.31914	7082.0
15	21.8	22714.0	0.29414	6681.1
16	21.4	23272.0	0.27110	6309.0
17	21.1	23690.5	0.24986	5919.3
18	20.[illegible]	24310.0	0.23028	5598.2
19	20.3	24950.0	0.21224	5295.5
20	20.0	25430.0	0.19562	4974.5
21	19.6	26167.2	0.18029	[illegible]717.7
22	19.2	[illegible]4904.4	0.16617	4470.6
23	19.0	27273.0	0.15315	4176.9
24	19.0	27273.0	0.14115	3849.6
25	19.0	27273.0	0.13009	3548.0
26	19.0	27273.0	0.11990	3270.1
27	19.0	27273.0	0.11051	3013.9
28	19.0	27273.0	0.10185	2777.8
29	19.0	27273.0	0.09387	2560.2
30	[illegible]	27273.0	0.08652	2359.6
31	19.0	27273.0	0.07974	2174.8
32	19.0	27273.0	0.07349	2004.4
33	19.0	27273.0	0.06774	1847.4
34	19.0	27273.0	0.06243	1702.6
35	19.0	27273.0	0.05754	1569.2
36	19.0	27273.0	0.05303	1446.3
37	19.0	27273.0	0.04888	1333.0
38	19.0	27273.0	0.04505	1228.6
39	19.0	27273.0	0.04152	1132.3
40	19.0	27273.0	0.03827	1043.6
41	19.0	27273.0	0.03527	961.9
42	19.0	27273.0	0.03251	886.5
43	19.0	27273.0	0.02996	817.1
44	19.0	27273.0	0.02761	753.1
45	19.0	27273.0	0.02545	694.1
46	19.0	27273.0	0.02345	639.7
47	19.0	27273.0	0.02162	589.6
48	19.0	27273.0	0.01992	543.4
49	19.0	27273.0	0.01836	500.8
50	19.0	27273.0	0.01692	461.6

SUM OF PRESENT WORTHS				247282.4
PARTIAL PAYMENT FACTOR				0.08646

AVERAGE ANNUAL VALUE				21380.9

WITH PROJECT CONDITION ($000)

PROJECT YEAR	LWD CHANNEL DEPTH	OUTER HARBOR TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE
1	27.0	18,107	0.92166	16,688.5
2	27.0	18,107	0.84946	15,381.1
3	27.0	18,107	0.78291	14,176.1
4	27.0	18,107	0.72157	13,065.5
5	27.0	18,107	0.66505	12,042.0
6	27.0	18,107	0.61295	11,098.6
7	27.0	18,107	0.56493	10,229.1
8	27.0	18,107	0.52067	9,427.8
9	27.0	18,107	0.47988	8,689.2
10	27.0	18,107	0.44229	8,008.5
11	27.0	18,107	0.40764	7,381.1
12	27.0	18,107	0.37570	6,802.8
13	27.0	18,107	0.34627	6,269.9
14	27.0	18,107	0.31914	5,778.7
15	27.0	18,107	0.29414	5,326.0
16	26.6	18,275	0.27110	4,954.3
17	26.3	18,401	0.24986	4,597.6
18	25.9	18,597	0.23028	4,282.6
19	25.5	18,876	0.21224	4,006.3
20	25.1	19,155	0.19562	3,747.1
21	24.8	19,407	0.18029	3,499.0
22	24.4	19,772	0.16617	3,285.4
23	24.0	20,136	0.15315	3,083.8
24	23.7	20,459	0.14115	2,887.9
25	23.3	20,891	0.13009	2,717.7
26	22.9	21,336	0.11990	2,558.2
27	22.6	21,702	0.11051	2,398.3
28	22.2	22,191	0.10185	2,260.2
29	21.8	22,714	0.09387	2,132.2
30	21.4	23,272	0.08652	2,013.5
31	21.1	23,671	0.07974	1,889.1
32	20.7	24,310	0.07349	1,786.6
33	20.3	24,950	0.06774	1,690.0
34	20.0	25,430	0.06243	1,587.6
35	19.6	26,167	0.05754	1,505.6
36	19.2	26,904	0.05303	1,426.8
37	19.0	27,273	0.04888	1,333.0
38	19.0	27,273	0.04505	1,228.6
39	19.0	27,273	0.04152	1,132.3
40	19.0	27,273	0.03827	1,043.6
41	19.0	27,273	0.03527	961.9
42	19.0	27,273	0.03251	886.5
43	19.0	27,273	0.02996	817.1
44	19.0	27,273	0.02761	753.1
45	19.0	27,273	0.02545	694.1
46	19.0	27,273	0.02345	639.7
47	19.0	27,273	0.02162	589.6
48	19.0	27,273	0.01992	543.4
49	19.0	27,273	0.01836	500.8
50	19.0	27,273	0.01692	461.6

				220,259.7
				0.08646

				19,044.4

Table B 22B-Annual Transportation Costs - Lower Cuyahoga Iron Ore

WITHOUT PROJECT CONDITION ($000)

PROJECT YEAR	LWD CHANNEL DEPTH	LOWER RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE
1	23.0	531.0	0.92166	489.4
2	22.6	537.4	0.84946	456.5
3	22.3	542.2	0.78291	424.5
4	21.9	548.9	0.72157	396.1
5	21.5	556.5	0.66505	370.1
6	21.1	564.1	0.61295	345.8
7	20.8	571.2	0.56493	322.7
8	20.4	581.6	0.52067	302.8
9	20.0	592.0	0.47988	284.1
10	19.7	600.7	0.44229	265.7
11	19.3	612.3	0.40764	249.6
12	18.9	624.2	0.37570	234.5
13	18.6	633.8	0.34627	219.5
14	18.2	646.6	0.31914	206.4
15	17.8	662.0	0.29414	194.7
16	17.4	680.0	0.27110	184.3
17	17.1	693.5	0.24986	173.3
18	16.7	713.9	0.23028	164.4
19	16.3	735.1	0.21224	156.0
20	16.0	751.0	0.19562	146.9
21	15.6	777.8	0.18029	140.2
22	15.2	804.6	0.16617	133.7
23	15.0	818.0	0.15315	125.3
24	15.0	818.0	0.14115	115.5
25	15.0	818.0	0.13009	106.4
26	15.0	818.0	0.11990	98.1
27	15.0	818.0	0.11051	90.4
28	15.0	818.0	0.10185	83.3
29	15.0	818.0	0.09387	76.8
30	15.0	818.0	0.08652	70.8
31	15.0	818.0	0.07974	65.2
32	15.0	818.0	0.07349	60.1
33	15.0	818.0	0.06774	55.4
34	15.0	818.0	0.06243	51.1
35	15.0	818.0	0.05754	47.1
36	15.0	818.0	0.05303	43.4
37	15.0	818.0	0.04888	40.0
38	15.0	818.0	0.04505	36.8
39	15.0	818.0	0.04152	34.0
40	15.0	818.0	0.03827	31.3
41	15.0	818.0	0.03527	28.8
42	15.0	818.0	0.03251	26.6
43	15.0	818.0	0.02996	24.5
44	15.0	818.0	0.02761	22.6
45	15.0	818.0	0.02545	20.8
46	15.0	818.0	0.02345	19.2
47	15.0	818.0	0.02162	17.7
48	15.0	818.0	0.01992	16.3
49	15.0	818.0	0.01836	15.0
50	15.0	818.0	0.01692	13.8

SUM OF PRESENT WORTHS				7,297.4
PARTIAL PAYMENT FACTOR				0.08646

AVERAGE ANNUAL VALUE				631.0

WITH PROJECT CONDITION ($000)

PROJECT YEAR	LWD CHANNEL DEPTH	LOWER RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE
1	23.0	531.0	0.92166	489.4
2	23.0	531.0	0.84946	451.1
3	23.0	531.0	0.78291	415.7
4	23.0	531.0	0.72157	383.2
5	23.0	531.0	0.66505	353.1
6	23.0	531.0	0.61295	325.5
7	23.0	531.0	0.56493	300.0
8	23.0	531.0	0.52067	276.5
9	23.0	531.0	0.47988	254.8
10	23.0	531.0	0.44229	234.9
11	23.0	531.0	0.40764	216.5
12	23.0	531.0	0.37570	199.5
13	23.0	531.0	0.34627	183.9
14	23.0	531.0	0.31914	169.5
15	23.0	531.0	0.29414	156.2
16	22.6	537.4	0.27110	145.7
17	22.3	542.2	0.24986	135.5
18	21.9	548.9	0.23028	126.4
19	21.5	556.5	0.21224	118.1
20	21.1	564.1	0.19562	110.3
21	20.8	571.2	0.18029	103.0
22	20.4	581.6	0.16617	96.6
23	20.0	592.0	0.15315	90.7
24	19.7	600.7	0.14115	84.8
25	19.3	612.3	0.13009	79.7
26	18.9	624.2	0.11990	74.8
27	18.6	633.8	0.11051	70.0
28	18.2	646.6	0.10185	65.9
29	17.8	662.0	0.09387	62.1
30	17.4	680.0	0.08652	58.8
31	17.1	693.5	0.07974	55.3
32	16.7	713.9	0.07349	52.5
33	16.3	735.1	0.06774	49.8
34	16.0	751.0	0.06243	46.9
35	15.6	777.8	0.05754	44.8
36	15.2	804.6	0.05303	42.7
37	15.0	818.0	0.04888	40.0
38	15.0	818.0	0.04505	36.8
39	15.0	818.0	0.04152	34.0
40	15.0	818.0	0.03827	31.3
41	15.0	818.0	0.03527	28.8
42	15.0	818.0	0.03251	26.6
43	15.0	818.0	0.02996	24.5
44	15.0	818.0	0.02761	22.6
45	15.0	818.0	0.02545	20.8
46	15.0	818.0	0.02345	19.2
47	15.0	818.0	0.02162	17.7
48	15.0	818.0	0.01992	16.3
49	15.0	818.0	0.01836	15.0
50	15.0	818 0	0.01692	13.8

				6,471.4
				0.08646

				559.5

Table B 22C-Annual Transportation Costs - Upper Cuyahoga Iron Ore: Docks With .7 Feet Of Shoaling Per Year

WITHOUT PROJECT CONDITION ($000)

PROJECT YEAR	LWD CHANNEL DEPTH	UPPER RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE
1	23.0	326.0	0.92166	300.5
2	22.3	335.1	0.84946	284.7
3	21.6	344.6	0.78291	269.8
4	20.9	354.5	0.72157	255.8
5	20.2	365.0	0.66505	242.7
6	19.5	377.0	0.61295	231.1
7	18.8	390.6	0.56493	220.7
8	18.1	406.7	0.52067	211.8
9	17.4	425.2	0.47988	204.0
10	16.7	446.2	0.44229	197.3
11	16.0	470.0	0.40764	191.6
12	15.3	498.7	0.37570	187.4
13	15.0	511.0	0.34627	176.9
14	15.0	511.0	0.31914	163.1
15	15.0	511.0	0.29414	150.3
16	15.0	511.0	0.27110	138.5
17	15.0	511.0	0.24986	127.7
18	15.0	511.0	0.23028	117.7
19	15.0	511.0	0.21224	108.5
20	15.0	511.0	0.19562	100.0
21	15.0	511.0	0.18029	92.1
22	15.0	511.0	0.16617	84.9
23	15.0	511.0	0.15315	78.3
24	15.0	511.0	0.14115	72.1
25	15.0	511.0	0.13009	66.5
26	15.0	511.0	0.11990	61.3
27	15.0	511.0	0.11051	56.5
28	15.0	511.0	0.10185	52.0
29	15.0	511.0	0.09387	48.0
30	15.0	511.0	0.08652	44.2
31	15.0	511.0	0.07974	40.7
32	15.0	511.0	0.07349	37.6
33	15.0	511.0	0.06774	34.6
34	15.0	511.0	0.06243	31.9
35	15.0	511.0	0.05754	29.4
36	15.0	511.0	0.05303	27.1
37	15.0	511.0	0.04888	25.0
38	15.0	511.0	0.04505	23.0
39	15.0	511.0	0.04152	21.2
40	15.0	511.0	0.03827	19.6
41	15.0	511.0	0.03527	18.0
42	15.0	511.0	0.03251	16.6
43	15.0	511.0	0.02996	15.3
44	15.0	511.0	0.02761	14.1
45	15.0	511.0	0.02545	13.0
46	15.0	511.0	0.02345	12.0
47	15.0	511.0	0.02162	11.0
48	15.0	511.0	0.01992	10.2
49	15.0	511.0	0.01836	9.4
50	15.0	511.0	0.01692	8.6
SUM OF PRESENT WORTHS				4954.2
PARTIAL PAYMENT FACTOR				0.08646
AVERAGE ANNUAL VALUE				428.4

WITH PROJECT CONDITION ($000)

PROJECT YEAR	LWD CHANNEL DEPTH	UPPER RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE
1	23.0	326.0	0.92166	300.5
2	23.0	326.0	0.84946	276.9
3	23.0	326.0	0.78291	255.2
4	23.0	326.0	0.72157	235.2
5	23.0	326.0	0.66505	216.8
6	23.0	326.0	0.61295	199.8
7	23.0	326.0	0.56493	184.2
8	23.0	326.0	0.52067	169.7
9	23.0	326.0	0.47988	156.4
10	23.0	326.0	0.44229	144.2
11	23.0	326.0	0.40764	132.9
12	23.0	326.0	0.37570	122.5
13	23.0	326.0	0.34627	112.9
14	23.0	326.0	0.31914	104.0
15	23.0	326.0	0.29414	95.9
16	22.3	335.1	0.27110	90.8
17	21.6	344.6	0.24986	86.1
18	20.9	354.5	0.23028	81.6
19	20.2	365.0	0.21224	77.5
20	19.5	377.0	0.19562	73.7
21	18.8	390.6	0.18029	70.4
22	18.1	406.7	0.16617	67.6
23	17.4	425.2	0.15315	65.1
24	16.7	446.2	0.14115	63.0
25	16.0	470.0	0.13009	61.1
26	15.3	498.7	0.11990	59.8
27	15.0	511.0	0.11051	56.5
28	15.0	511.0	0.10185	52.0
29	15.0	511.0	0.09387	48.0
30	15.0	511.0	0.08652	44.2
31	15.0	511.0	0.07974	40.7
32	15.0	511.0	0.07349	37.6
33	15.0	511.0	0.06774	34.6
34	15.0	511.0	0.06243	31.9
35	15.0	511.0	0.05754	29.4
36	15.0	511.0	0.05303	27.1
37	15.0	511.0	0.04888	25.0
38	15.0	511.0	0.04505	23.0
39	15.0	511.0	0.04152	21.2
40	15.0	511.0	0.03827	19.6
41	15.0	511.0	0.03527	18.0
42	15.0	511.0	0.03251	16.6
43	15.0	511.0	0.02996	15.3
44	15.0	511.0	0.02761	14.1
45	15.0	511.0	0.02545	13.0
46	15.0	511.0	0.02345	12.0
47	15.0	511.0	0.02162	11.0
48	15.0	511.0	0.01992	10.2
49	15.0	511.0	0.01836	9.4
50	15.0	511.0	0.01692	8.6
				4123.1
				0.08646
				356.5

Table B 22D-Annual Transportation Costs - Upper Cuyahoga Iron Ore: Docks With 1.06 Feet Of Shoaling Per Year

	WITHOUT PROJECT CONDITION ($000)			
	LWD	UPPE RIVER	PRESENT	PRESENT
PROJECT	CHANNEL	TRANS	WORTH	WORTH
YEAR	DEPTH	COSTS	FACTOR	VALUE
1	23.0	5191.0	0.92166	4784.3
2	21.9	5422.5	0.84966	4606.2
3	20.9	5661.1	0.78291	4432.1
4	19.8	5960.4	0.72157	4300.9
5	18.8	6267.0	0.66505	4167.8
6	17.7	6743.8	0.61295	4133.6
7	16.6	7290.2	0.56493	4118.4
8	15.6	7904.2	0.52067	4115.5
9	15.0	8314.0	0.47988	3989.7
10	15.0	8314.0	0.44229	3677.2
11	15.0	8314.0	0.40764	3389.1
12	15.0	8314.0	0.37570	3123.6
13	15.0	8314.0	0.34627	2878.9
14	15.0	8314.0	0.31914	2653.3
15	15.0	8314.0	0.29414	2445.5
16	15.0	8314.0	0.27110	2253.9
17	15.0	8314.0	0.24986	2077.3
18	15.0	8314.0	0.23028	1914.6
19	15.0	8314.0	0.21224	1764.6
20	15.0	8314.0	0.19562	1626.4
21	15.0	8314.0	0.18029	1498.9
22	15.0	8314.0	0.16617	1381.5
23	15.0	8314.0	0.15315	1273.3
24	15.0	8314.0	0.14115	1173.5
25	15.0	8314.0	0.13009	1081.6
26	15.0	8314.0	0.11990	996.9
27	15.0	8314.0	0.11051	918.8
28	15.0	8314.0	0.10185	846.8
29	15.0	8314.0	0.09387	780.5
30	15.0	8314.0	0.08652	719.3
31	15.0	8314.0	0.07974	663.0
32	15.0	8314.0	0.07349	611.0
33	15.0	8314.0	0.06774	563.2
34	15.0	8314.0	0.06243	519.0
35	15.0	8314.0	0.05754	478.4
36	15.0	8314.0	0.05303	440.9
37	15.0	8314.0	0.04888	406.4
38	15.0	8314.0	0.04505	374.5
39	15.0	8314.0	0.04152	345.2
40	15.0	8314.0	0.03827	318.1
41	15.0	8314.0	0.03527	293.2
42	15.0	8314.0	0.03251	270.2
43	15.0	8314.0	0.02996	249.1
44	15.0	8314.0	0.02761	229.6
45	15.0	8314.0	0.02545	211.6
46	15.0	8314.0	0.02345	195.0
47	15.0	8314.0	0.02162	179.7
48	15.0	8314.0	0.01992	165.6
49	15.0	8314.0	0.01836	152.7
50	15.0	8314.0	0.01692	140.7

SUM OF PRESENT WORTHS				83931.0
PARTIAL PAYMENT FACTOR				0.08646

AVERAGE ANNUAL VALUE				7257.0

	WITH PROJECT CONDITION ($000)			
	LWD UPPER RIVER		PRESENT	PRESENT
PROJECT	CHANNEL	TRANS	WORTH	WORTH
YEAR	DEPTH	COSTS	FACTOR	VALUE
1	23.0	5191.0	0.92166	4784.3
2	23.0	5191.0	0.84966	4409.5
3	23.0	5191.0	0.78291	4064.1
4	23.0	5191.0	0.72157	3745.7
5	23.0	5191.0	0.66505	3452.3
6	23.0	5191.0	0.61295	3181.8
7	23.0	5191.0	0.56493	2932.5
8	23.0	5191.0	0.52067	2702.8
9	23.0	5191.0	0.47988	2491.1
10	23.0	5191.0	0.44229	2295.9
11	23.0	5191.0	0.40764	2116.0
12	23.0	5191.0	0.37570	1950.3
13	23.0	5191.0	0.34627	1797.5
14	23.0	5191.0	0.31914	1656.7
15	23.0	5191.0	0.29414	1526.9
16	21.9	5422.5	0.27110	1470.0
17	20.9	5661.1	0.24986	1414.5
18	19.8	5960.4	0.23028	1372.6
19	18.8	6267.0	0.21224	1330.1
20	17.7	6743.8	0.19562	1319.2
21	16.6	7290.2	0.18029	1314.4
22	15.6	7904.2	0.16617	1313.4
23	15.0	8314.0	0.15315	1273.3
24	15.0	8314.0	0.14115	1173.5
25	15.0	8314.0	0.13009	1081.6
26	15.0	8314.0	0.11990	996.9
27	15.0	8314.0	0.11051	918.8
28	15.0	8314.0	0.10185	846.8
29	15.0	8314.0	0.09387	780.5
30	15.0	8314.0	0.08652	719.3
31	15.0	8314.0	0.07974	663.0
32	15.0	8314.0	0.07349	611.0
33	15.0	8314.0	0.06774	563.2
34	15.0	8314.0	0.06243	519.0
35	15.0	8314.0	0.05754	478.4
36	15.0	8314.0	0.05303	440.9
37	15.0	8314.0	0.04888	406.4
38	15.0	8314.0	0.04505	374.5
39	15.0	8314.0	0.04152	345.2
40	15.0	8314.0	0.03827	318.1
41	15.0	8314.0	0.03527	293.2
42	15.0	8314.0	0.03251	270.2
43	15.0	8314.0	0.02996	249.1
44	15.0	8314.0	0.02761	229.6
45	15.0	8314.0	0.02545	211.6
46	15.0	8314.0	0.02345	195.0
47	15.0	8314.0	0.02162	179.7
48	15.0	8314.0	0.01992	165.6
49	15.0	8314.0	0.01836	152.7
50	15.0	8314.0	0.01692	140.7

SUM OF PRESENT WORTHS				67239.2
PARTIAL PAYMENT FACTOR				0.08646

AVERAGE ANNUAL VALUE				5813.7

Table B 23A-Annual Transportation Costs- Lower River Limestone: Docks With .37 Feet Of shoaling Per Year

	WITHOUT PROJECT CONDITION ($000)					WITH PROJECT CONDITION $000) (1,177,193 TONS)			
PROJECT YEAR	LMD CHANNEL DEPTH	LMR RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE	PROJECT YEAR	LMD CHANNEL DEPTH	LMR RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE
1	23.0	6,262.0	0.92166	5,771.4	1	23.0	6,262.0	0.92166	5,771.4
2	22.6	6,389.6	0.84946	5,427.7	2	23.0	6,262.0	0.84946	5,319.3
3	22.3	6,485.3	0.78291	5,077.4	3	23.0	6,262.0	0.78291	4,902.6
4	21.9	6,620.0	0.72157	4,889.4	4	23.0	6,262.0	0.72157	4,518.5
5	21.5	6,776.0	0.66505	4,610.1	5	23.0	6,262.0	0.66505	4,164.5
6	21.1	6,932.0	0.61295	4,248.9	6	23.0	6,262.0	0.61295	3,838.3
7	20.8	7,063.4	0.56493	3,990.3	7	23.0	6,262.0	0.56493	3,537.6
8	20.4	7,248.2	0.52067	3,773.9	8	23.0	6,262.0	0.52067	3,260.4
9	20.0	7,433.0	0.47988	3,566.9	9	23.0	6,262.0	0.47988	3,005.0
10	19.7	7,595.6	0.44229	3,359.4	10	23.0	6,262.0	0.44229	2,769.6
11	19.3	7,812.4	0.40764	3,184.6	11	23.0	6,262.0	0.40764	2,552.6
12	18.9	8,040.2	0.37570	3,020.7	12	23.0	6,262.0	0.37570	2,352.6
13	18.6	8,235.8	0.34627	2,851.8	13	23.0	6,262.0	0.34627	2,168.3
14	18.2	8,496.6	0.31914	2,711.6	14	23.0	6,262.0	0.31914	1,998.5
15	17.8	8,784.8	0.29414	2,584.0	15	23.0	6,262.0	0.29414	1,841.9
16	17.4	9,100.4	0.27110	2,467.1	16	22.6	6,389.6	0.27110	1,732.2
17	17.1	9,337.1	0.24986	2,333.0	17	22.3	6,485.3	0.24986	1,620.4
18	16.7	9,709.4	0.23028	2,235.9	18	21.9	6,620.0	0.23028	1,524.5
19	16.3	10,100.6	0.21224	2,143.8	19	21.5	6,776.0	0.21224	1,438.2
20	16.0	10,394.0	0.19562	2,033.2	20	21.1	6,932.0	0.19562	1,356.0
21	15.6	10,891.2	0.18029	1,963.6	21	20.8	7,063.4	0.18029	1,273.5
22	15.2	11,388.4	0.16617	1,892.4	22	20.4	7,248.2	0.16617	1,204.4
23	15.0	11,388.4	0.15315	1,744.1	23	20.0	7,433.0	0.15315	1,138.4
24	15.0	11,388.4	0.14115	1,607.5	24	19.7	7,595.6	0.14115	1,072.1
25	15.0	11,388.4	0.13009	1,481.6	25	19.3	7,812.4	0.13009	1,016.3
26	15.0	11,388.4	0.11990	1,365.5	26	18.9	8,040.2	0.11990	964.0
27	15.0	11,388.4	0.11051	1,258.5	27	18.6	8,235.8	0.11051	910.1
28	15.0	11,388.4	0.10185	1,159.9	28	18.2	8,496.6	0.10185	865.4
29	15.0	11,388.4	0.09387	1,069.1	29	17.8	8,784.8	0.09387	824.6
30	15.0	11,388.4	0.08652	985.3	30	17.4	9,100.4	0.08652	787.4
31	15.0	11,388.4	0.07974	908.1	31	17.1	9,337.1	0.07974	744.5
32	15.0	11,388.4	0.07349	837.0	32	16.7	9,709.4	0.07349	713.6
33	15.0	11,388.4	0.06774	771.4	33	16.3	10,100.6	0.06774	684.2
34	15.0	11,388.4	0.06243	711.0	34	16.0	10,394.0	0.06243	648.9
35	15.0	11,388.4	0.05754	655.3	35	15.6	10,891.2	0.05754	626.7
36	15.0	11,388.4	0.05303	603.9	36	15.2	11,388.4	0.05303	603.9
37	15.0	11,388.4	0.04888	556.6	37	15.0	11,388.4	0.04888	556.6
38	15.0	11,388.4	0.04505	513.0	38	15.0	11,388.4	0.04505	513.0
39	15.0	11,388.4	0.04152	472.8	39	15.0	11,388.4	0.04152	472.8
40	15.0	11,388.4	0.03827	435.8	40	15.0	11,388.4	0.03827	435.8
41	15.0	11,388.4	0.03527	401.6	41	15.0	11,388.4	0.03527	401.6
42	15.0	11,388.4	0.03251	370.2	42	15.0	11,388.4	0.03251	370.2
43	15.0	11,388.4	0.02996	341.2	43	15.0	11,388.4	0.02996	341.2
44	15.0	11,388.4	0.02761	314.5	44	15.0	11,388.4	0.02761	314.5
45	15.0	11,388.4	0.02545	289.8	45	15.0	11,388.4	0.02545	289.8
46	15.0	11,388.4	0.02345	267.1	46	15.0	11,388.4	0.02345	267.1
47	15.0	11,388.4	0.02162	246.2	47	15.0	11,388.4	0.02162	246.2
48	15.0	11,388.4	0.01992	226.9	48	15.0	11,388.4	0.01992	226.9
49	15.0	11,388.4	0.01836	209.1	49	15.0	11,388.4	0.01836	209.1
50	15.0	11,388.4	0.01692	192.7	50	15.0	11,388.4	0.01692	192.7
SUM OF PRESENT WORTHS				94,132.9					78,588.1
PARTIAL PAYMENT FACTOR				0.08646					0.08646
AVERAGE ANNUAL VALUE				8.139.0					6.795

Table B 23B-Annual Transportation Costs- Middle River Limestone: Docks With .44 Feet Of shoaling Per Year

	WITHOUT PROJECT CONDITION ($000)					WITH PROJECT CONDITION ($000)			
	LWD	MDLE RIVER	PRESENT	PRESENT		LWD	MDLE RIVER		
PROJECT	CHANNEL	TRANS	WORTH	WORTH	PROJECT	CHANNEL	TRANS	WORTH	WORTH
YEAR	DEPTH	COSTS	FACTOR	VALUE	YEAR	DEPTH	COSTS	FACTOR	VALUE
1	23.0	919.0	0.92166	847.0	1	23.0	919.0	0.92166	847.0
2	22.6	929.4	0.84946	789.5	2	23.0	919.0	0.84946	780.6
3	22.1	942.4	0.78291	737.8	3	23.0	919.0	0.78291	719.5
4	21.7	955.2	0.72157	689.2	4	23.0	919.0	0.72157	663.1
5	21.2	972.2	0.66505	646.6	5	23.0	919.0	0.66505	611.2
6	20.8	988.2	0.61295	605.7	6	23.0	919.0	0.61295	563.3
7	20.4	1006.6	0.56493	568.7	7	23.0	919.0	0.56493	519.2
8	19.9	1030.6	0.52067	536.6	8	23.0	919.0	0.52067	478.5
9	19.5	1053.0	0.47988	505.3	9	23.0	919.0	0.47988	441.0
10	19.0	1081.0	0.44229	478.1	10	23.0	919.0	0.44229	406.5
11	18.6	1108.6	0.40764	451.9	11	23.0	919.0	0.40764	374.6
12	18.2	1136.2	0.37570	426.9	12	23.0	919.0	0.37570	345.3
13	17.7	1174.3	0.34627	406.6	13	23.0	919.0	0.34627	318.2
14	17.3	1206.7	0.31914	385.1	14	23.0	919.0	0.31914	293.3
15	16.8	1251.4	0.29414	368.1	15	23.0	919.0	0.29414	270.3
16	16.4	1292.2	0.27110	350.3	16	22.6	929.4	0.27110	252.0
17	16.0	1333.0	0.24986	333.1	17	22.1	942.4	0.24986	235.5
18	15.5	1397.5	0.23028	321.8	18	21.7	955.2	0.23028	220.0
19	15.1	1449.1	0.21224	307.6	19	21.2	972.2	0.21224	206.3
20	15.0	1462.0	0.19562	286.0	20	20.8	988.2	0.19562	193.3
21	15.0	1462.0	0.18029	263.6	21	20.4	1006.6	0.18029	181.5
22	15.0	1462.0	0.16617	242.9	22	19.9	1030.6	0.16617	171.3
23	15.0	1462.0	0.15315	223.9	23	19.5	1053.0	0.15315	161.3
24	15.0	1462.0	0.14115	206.4	24	19.0	1081.0	0.14115	152.6
25	15.0	1462.0	0.13009	170.2	25	18.6	1108.6	0.13009	144.2
26	15.0	1462.0	0.11990	175.3	26	18.2	1136.2	0.11990	136.2
27	15.0	1462.0	0.11051	161.6	27	17.7	1174.3	0.11051	129.8
28	15.0	1462.0	0.10185	148.9	28	17.3	1206.7	0.10185	122.9
29	15.0	1462.0	0.09387	137.2	29	16.8	1251.4	0.09387	117.5
30	15.0	1462.0	0.08652	126.5	30	16.4	1292.2	0.08652	111.8
31	15.0	1462.0	0.07974	116.6	31	16.0	1333.0	0.07974	106.3
32	15.0	1462.0	0.07349	107.4	32	15.5	1397.5	0.07349	102.7
33	15.0	1462.0	0.06774	99.0	33	15.1	1449.1	0.06774	98.2
34	15.0	1462.0	0.06243	91.3	34	15.0	1462.0	0.06243	91.3
35	15.0	1462.0	0.05754	84.1	35	15.0	1462.0	0.05754	84.1
36	15.0	1462.0	0.05303	77.5	36	15.0	1462.0	0.05303	77.5
37	15.0	1462.0	0.04888	71.5	37	15.0	1462.0	0.04888	71.5
38	15.0	1462.0	0.04505	65.9	38	15.0	1462.0	0.04505	65.9
39	15.0	1462.0	0.04152	60.7	39	15.0	1462.0	0.04152	60.7
40	15.0	1462.0	0.03827	55.9	40	15.0	1462.0	0.03827	55.9
41	15.0	1462.0	0.03527	51.6	41	15.0	1462.0	0.03527	51.6
42	15.0	1462.0	0.03251	47.5	42	15.0	1462.0	0.03251	47.5
43	15.0	1462.0	0.02996	43.8	43	15.0	1462.0	0.02996	43.8
44	15.0	1462.0	0.02761	40.4	44	15.0	1462.0	0.02761	40.4
45	15.0	1462.0	0.02545	37.2	45	15.0	1462.0	0.02545	37.2
46	15.0	1462.0	0.02345	34.3	46	15.0	1462.0	0.02345	34.3
47	15.0	1462.0	0.02162	31.6	47	15.0	1462.0	0.02162	31.6
48	15.0	1462.0	0.01992	29.1	48	15.0	1462.0	0.01992	29.1
49	15.0	1462.0	0.01836	26.8	49	15.0	1462.0	0.01836	26.8
50	15.0	1462.0	0.01692	24.7	50	15.0	1462.0	0.01692	24.7
				------					------
SUM OF PRESENT WORTHS				13,115.3					11,348.7
PARTIAL PAYMENT FACTOR				0.08646					0.08646
				------					------
AVERAGE ANNUAL VALUE				1,134.0					981.2

Table B 23C-Annual Transportation Costs- Middle River Limestone: Docks With .53 Feet Of shoaling Per Year

WITHOUT PROJECT CONDITION ($000)

YEAR	LWD MIDDLE RIVER CHANNEL DEPTH	TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE
1	23.0	279.0	0.92166	257.1
2	22.5	279.5	0.84946	237.4
3	21.9	280.4	0.78291	219.5
4	21.4	282.4	0.72157	203.8
5	20.9	285.1	0.66505	189.6
6	20.3	291.7	0.61295	178.8
7	19.8	298.6	0.56493	168.7
8	19.3	307.6	0.52067	160.2
9	18.8	317.8	0.47988	152.5
10	18.2	332.2	0.44229	146.9
11	17.7	345.7	0.40764	140.9
12	17.2	360.2	0.37570	135.3
13	16.6	380.4	0.34627	131.7
14	16.1	398.4	0.31914	127.1
15	15.6	419.6	0.29414	123.4
16	15.0	446.0	0.27110	120.9
17	15.0	446.0	0.24986	111.4
18	15.0	446.0	0.23028	102.7
19	15.0	446.0	0.21224	94.7
20	15.0	446.0	0.19562	87.2
21	15.0	446.0	0.18029	80.4
22	15.0	446.0	0.16617	74.1
23	15.0	446.0	0.15315	68.3
24	15.0	446.0	0.14115	63.0
25	15.0	446.0	0.13009	58.0
26	15.0	446.0	0.11990	53.5
27	15.0	446.0	0.11051	49.3
28	15.0	446.0	0.10185	45.4
29	15.0	446.0	0.09387	41.9
30	15.0	446.0	0.08652	38.6
31	15.0	446.0	0.07974	35.6
32	15.0	446.0	0.07349	32.8
33	15.0	446.0	0.06774	30.2
34	15.0	446.0	0.06243	27.8
35	15.0	446.0	0.05754	25.7
36	15.0	446.0	0.05303	23.7
37	15.0	446.0	0.04888	21.8
38	15.0	446.0	0.04505	20.1
39	15.0	446.0	0.04152	18.5
40	15.0	446.0	0.03827	17.1
41	15.0	446.0	0.03527	15.7
42	15.0	446.0	0.03251	14.5
43	15.0	446.0	0.02996	13.4
44	15.0	446.0	0.02761	12.3
45	15.0	446.0	0.02545	11.4
46	15.0	446.0	0.02345	10.5
47	15.0	446.0	0.02162	9.6
48	15.0	446.0	0.01992	8.9
49	15.0	446.0	0.01836	8.2
50	15.0	446.0	0.01692	7.5

SUM OF PRESENT WORTHS				4,027.6
PARTIAL PAYMENT FACTOR				0.08646

AVERAGE ANNUAL VALUE				348.2

WITH PROJECT CONDITION ($000)

PROJECT YEAR	LWD MIDDLE RIVER CHANNEL DEPTH	TRANS COSTS	WORTH FACTOR	WORTH VALUE
1	23.0	279.0	0.92166	257.1
2	23.0	279.0	0.84946	236.9
3	23.0	279.0	0.78291	218.4
4	23.0	279.0	0.72157	201.3
5	23.0	279.0	0.66505	185.5
6	23.0	279.0	0.61295	171.0
7	23.0	279.0	0.56493	157.6
8	23.0	279.0	0.52067	145.3
9	23.0	279.0	0.47988	133.9
10	23.0	279.0	0.44229	123.4
11	23.0	279.0	0.40764	113.7
12	23.0	279.0	0.37570	104.8
13	23.0	279.0	0.34627	96.6
14	23.0	279.0	0.31914	89.0
15	23.0	279.0	0.29414	82.1
16	22.5	279.5	0.27110	75.8
17	21.9	280.4	0.24986	70.1
18	21.4	282.4	0.23028	65.0
19	20.9	285.1	0.21224	60.5
20	20.3	291.7	0.19562	57.1
21	19.8	298.6	0.18029	53.8
22	19.3	307.6	0.16617	51.1
23	18.8	317.8	0.15315	48.7
24	18.2	332.2	0.14115	46.9
25	17.7	345.7	0.13009	45.0
26	17.2	360.2	0.11990	43.2
27	16.6	380.4	0.11051	42.0
28	16.1	398.4	0.10185	40.6
29	15.6	419.6	0.09387	39.4
30	15.0	446.0	0.08652	38.6
31	15.0	446.0	0.07974	35.6
32	15.0	446.0	0.07349	32.8
33	15.0	446.0	0.06774	30.2
34	15.0	446.0	0.06243	27.8
35	15.0	446.0	0.05754	25.7
36	15.0	446.0	0.05303	23.7
37	15.0	446.0	0.04888	21.8
38	15.0	446.0	0.04505	20.1
39	15.0	446.0	0.04152	18.5
40	15.0	446.0	0.03827	17.1
41	15.0	446.0	0.03527	15.7
42	15.0	446.0	0.03251	14.5
43	15.0	446.0	0.02996	13.4
44	15.0	446.0	0.02761	12.3
45	15.0	446.0	0.02545	11.4
46	15.0	446.0	0.02345	10.5
47	15.0	446.0	0.02162	9.6
48	15.0	446.0	0.01992	8.9
49	15.0	446.0	0.01836	8.2
50	15.0	446.0	0.01692	7.5

				3,459.7
				0.08646

				299.1

Table B 23D-Annual Transportation Costs- Middle River Limestone: Docks With .59 Feet Of shoaling Per Year

WITHOUT PROJECT CONDITION ($000)					WITH PROJECT CONDITION ($000)				
PROJECT YEAR	LWD CHANNEL DEPTH	MIDDLE RVR TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE	PROJECT YEAR	LWD CHANNEL DEPTH	MDLE RVR TRANS COSTS	WORTH FACTOR	WORTH VALUE
1	23.0	58.0	0.92166	53.5	1	23.0	58.0	0.92166	53.5
2	22.4	58.0	0.84946	49.3	2	23.0	58.0	0.84946	49.3
3	21.8	58.4	0.78291	45.7	3	23.0	58.0	0.78291	45.4
4	21.2	59.6	0.72157	43.0	4	23.0	58.0	0.72157	41.9
5	20.6	60.8	0.66505	40.	5	23.0	58.0	0.66505	38.6
6	20.1	61.8	0.61295	37.	6	23.0	58.0	0.61295	35.6
7	19.5	63.5	0.56493	35.[illegible]	7	23.0	58.0	0.56493	32.8
8	18.9	65.3	0.52067	34.0	8	23.0	58.0	0.52067	30.2
9	18.3	67.1	0.47988	32.2	9	23.0	58.0	0.47988	27.8
10	17.7	69.2	0.44229	30.6	10	23.0	58.0	0.44229	25.7
11	17.1	71.6	0.40764	29.2	11	23.0	58.0	0.40764	23.6
12	16.5	74.5	0.37570	28.0	12	23.0	58.0	0.37570	21.8
13	15.9	77.6	0.34627	26.9	13	23.0	58.0	0.34627	20.1
14	15.3	81.2	0.31914	25.9	14	23.0	58.0	0.31914	18.5
15	15.0	83.0	0.29414	24.4	15	23.0	58.0	0.29414	17.1
16	15.0	83.0	0.27110	22.5	16	22.4	58.0	0.27110	15.7
17	15.0	83.0	0.24986	20.7	17	21.8	58.4	0.24986	14.6
18	15.0	83.0	0.23028	19.1	18	21.2	59.6	0.23028	13.7
19	15.0	83.0	0.21224	17.6	19	20.6	60.8	0.21224	12.9
20	15.0	83.0	0.19562	16.2	20	20.1	61.8	0.19562	12.1
21	15.0	83.0	0.18029	15.0	21	19.5	63.5	0.18029	11.4
22	15.0	83.0	0.16617	13.8	22	18.9	65.3	0.16617	10.9
23	15.0	83.0	0.15315	12.7	23	18.3	67.1	0.15315	10.3
24	15.0	83.0	0.14115	11.7	24	17.7	69.2	0.14115	9.8
25	15.0	83.0	0.13009	10.8	25	17.1	71.6	0.13009	9.3
26	15.0	83.0	0.11990	10.0	26	16.5	74.5	0.11990	8.9
27	15.0	83.0	0.11051	9.2	27	15.9	77.6	0.11051	8.6
28	15.0	83.0	0.10185	8.5	28	15.3	81.2	0.10185	8.3
29	15.0	83.0	0.09387	7.8	29	15.0	83.0	0.09387	7.8
30	15.0	83.0	0.08652	7.2	30	15.0	83.0	0.08652	7.2
31	15.0	83.0	0.07974	6.6	31	15.0	83.0	0.07974	6.6
32	15.0	83.0	0.07349	6.1	32	15.0	83.0	0.07349	6.1
33	15.0	83.0	0.06774	5.6	33	15.0	83.0	0.06774	5.6
34	15.0	83.0	0.06243	5.2	34	15.0	83.0	0.06243	5.2
35	15.0	83.0	0.05754	4.8	35	15.0	83.0	0.05754	4.8
36	15.0	83.0	0.05303	4.4	36	15.0	83.0	0.05303	4.4
37	15.0	83.0	0.04888	4.1	37	15.0	83.0	0.04888	4.1
38	15.0	83.0	0.04505	3.7	38	15.0	83.0	0.04505	3.7
39	15.0	83.0	0.04152	3.4	39	15.0	83.0	0.04152	3.4
40	15.0	83.0	0.03827	3.2	40	15.0	83.0	0.03827	3.2
41	15.0	83.0	0.03527	2.9	41	15.0	83.0	0.03527	2.9
42	15.0	83.0	0.03251	2.7	42	15.0	83.0	0.03251	2.7
43	15.0	83.0	0.02996	2.5	43	15.0	83.0	0.02996	2.5
44	15.0	83.0	0.02761	2.3	44	15.0	83.0	0.02761	2.3
45	15.0	83.0	0.02545	2.1	45	15.0	83.0	0.02545	2.1
46	15.0	83.0	0.02345	1.9	46	15.0	83.0	0.02345	1.9
47	15.0	83.0	0.02162	1.8	47	15.0	83.0	0.02162	1.8
48	15.0	83.0	0.01992	1.7	48	15.0	83.0	0.01992	1.7
49	15.0	83.0	0.01836	1.5	49	15.0	83.0	0.01836	1.5
50	15.0	83.0	0.01692	1.4	50	15.0	83.0	0.01692	1.4
				------					------
SUM OF PRESENT WORTHS				807.5					711.0
PARTIAL PAYMENT FACTOR				0.08646					0.08646
				------					------
AVERAGE ANNUAL VALUE				69.8					61.5

Table B 23E-Annual Transportation Costs- Middle River Limestone: Docks With .39 Feet Of shoaling Per Year

WITHOUT PROJECT CONDITION ($000)

PROJECT YEAR	LWD CHANNEL DEPTH	MIDDLE RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE
1	23.0	1965.0	0.92166	1,811.1
2	22.6	1998.2	0.84946	1,697.4
3	22.2	2031.4	0.78291	1,590.4
4	21.8	2069.6	0.72157	1,493.4
5	21.4	2112.8	0.66505	1,405.1
6	21.0	2156.0	0.61295	1,321.5
7	20.7	2194.7	0.56493	1,239.8
8	20.3	2246.3	0.52067	1,169.6
9	19.9	2300.1	0.47988	1,103.8
10	19.5	2360.5	0.44229	1,044.0
11	19.1	2420.9	0.40764	986.8
12	18.7	2490.0	0.37570	935.5
13	18.3	2562.0	0.34627	887.1
14	17.9	2637.1	0.31914	841.6
15	17.5	2721.5	0.29414	800.5
16	17.1	2805.9	0.27110	760.7
17	16.8	2878.0	0.24986	719.1
18	16.4	2980.0	0.23028	686.2
19	16.0	2929.0	0.21224	621.7
20	15.6	3207.2	0.19562	627.4
21	15.2	3332.4	0.18029	600.8
22	15.0	3395.0	0.16617	564.1
23	15.0	3395.0	0.15315	519.9
24	15.0	3395.0	0.14115	479.2
25	15.0	3395.0	0.13009	441.7
26	15.0	3395.0	0.11990	407.1
27	15.0	3395.0	0.11051	375.2
28	15.0	3395.0	0.10185	345.8
29	15.0	3395.0	0.09387	318.7
30	15.0	3395.0	0.08652	293.7
31	15.0	3395.0	0.07974	270.7
32	15.0	3395.0	0.07349	249.5
33	15.0	3395.0	0.06774	230.0
34	15.0	3395.0	0.06243	211.9
35	15.0	3395.0	0.05754	195.3
36	15.0	3395.0	0.05303	180.0
37	15.0	3395.0	0.04888	165.9
38	15.0	3395.0	0.04505	152.9
39	15.0	3395.0	0.04152	141.0
40	15.0	3395.0	0.03827	129.9
41	15.0	3395.0	0.03527	119.7
42	15.0	3395.0	0.03251	110.4
43	15.0	3395.0	0.02996	101.7
44	15.0	3395.0	0.02761	93.7
45	15.0	3395.0	0.02545	86.4
46	15.0	3395.0	0.02345	79.6
47	15.0	3395.0	0.02162	73.4
48	15.0	3395.0	0.01992	67.6
49	15.0	3395.0	0.01836	62.3
50	15.0	3395.0	0.01692	57.5

SUM OF PRESENT WORTHS				28,868.6
PARTIAL PAYMENT FACTOR				0.08646

AVERAGE ANNUAL VALUE				2.496.1

WITH PROJECT CONDITION ($000)

PROJECT YEAR	LWD CHANNEL DEPTH	MIDDLE RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE
1	23.0	1,965.0	0.92166	1,811.1
2	23.0	1,965.0	0.84946	1,669.2
3	23.0	1,965.0	0.78291	1,538.4
4	23.0	1,965.0	0.72157	1,417.9
5	23.0	1,965.0	0.66505	1,306.8
6	23.0	1,965.0	0.61295	1,204.4
7	23.0	1,965.0	0.56493	1,110.1
8	23.0	1,965.0	0.52067	1,023.1
9	23.0	1,965.0	0.47988	943.0
10	23.0	1,965.0	0.44229	869.1
11	23.0	1,965.0	0.40764	801.0
12	23.0	1,965.0	0.37570	738.3
13	23.0	1,965.0	0.34627	680.4
14	23.0	1,965.0	0.31914	627.1
15	23.0	1,965.0	0.29414	578.0
16	22.6	1,998.2	0.27110	541.7
17	22.2	2,031.4	0.24986	507.6
18	21.8	2,069.6	0.23028	476.6
19	21.4	2,112.8	0.21224	448.4
20	21.0	2,156.0	0.19562	421.7
21	20.7	2,194.7	0.18029	395.7
22	20.3	2,246.3	0.16617	373.3
23	19.9	2,300.1	0.15315	352.3
24	19.5	2,360.5	0.14115	333.2
25	19.1	2,420.9	0.13009	314.9
26	18.7	2,490.0	0.11990	298.6
27	18.3	2,562.0	0.11051	283.1
28	17.9	2,637.1	0.10185	268.6
29	17.5	2,721.5	0.09387	255.5
30	17.1	2,805.9	0.08652	242.8
31	16.8	2,878.0	0.07974	229.5
32	16.4	2,980.0	0.07349	219.0
33	16.0	2,929.0	0.06774	198.4
34	15.6	3,207.2	0.06243	200.2
35	15.2	3,332.4	0.05754	191.7
36	15.0	3,395.0	0.05303	180.0
37	15.0	3,395.0	0.04888	165.9
38	15.0	3,395.0	0.04505	152.9
39	15.0	3,395.0	0.04152	141.0
40	15.0	3,395.0	0.03827	129.9
41	15.0	3,395.0	0.03527	119.7
42	15.0	3,395.0	0.03251	110.4
43	15.0	3,395.0	0.02996	101.7
44	15.0	3,395.0	0.02761	93.7
45	15.0	3,395.0	0.02545	86.4
46	15.0	3,395.0	0.02345	79.6
47	15.0	3,395.0	0.02162	73.4
48	15.0	3,395.0	0.01992	67.6
49	15.0	3,395.0	0.01836	62.3
50	15.0	3,395.0	0.01692	57.5

				24,492.8
				0.08646

				2.117.7

Table B 23F-Annual Transportation Costs- Upper River Limestone: Docks With .7 Feet Of shoaling Per Year

WITHOUT PROJECT CONDITION ($000)

PROJECT YEAR	UPPR RIVER LWD CHNNL DEPTH	PRESENT TRANS COSTS	PRESENT WORTH FACTOR	WORTH VALUE
1	23.0	236.0	0.92166	217.5
2	22.3	244.4	0.84946	207.6
3	21.6	254.0	0.78291	198.9
4	20.9	264.7	0.72157	191.0
5	20.2	276.6	0.66505	184.0
6	19.5	290.0	0.61295	177.8
7	18.8	304.8	0.56493	172.2
8	18.1	321.6	0.52067	167.4
9	17.4	341.4	0.47988	163.8
10	16.7	363.8	0.44229	160.9
11	16.0	389.0	0.40764	158.6
12	15.3	419.8	0.37570	157.7
13	15.0	433.0	0.34627	149.9
14	15.0	433.0	0.31914	138.2
15	15.0	433.0	0.29414	127.4
16	15.0	433.0	0.27110	117.4
17	15.0	433.0	0.24986	108.2
18	15.0	433.0	0.23028	99.7
19	15.0	433.0	0.21224	91.9
20	15.0	433.0	0.19562	84.7
21	15.0	433.0	0.18029	78.1
22	15.0	433.0	0.16617	72.0
23	15.0	433.0	0.15315	66.3
24	15.0	433.0	0.14115	61.1
25	15.0	433.0	0.13009	56.3
26	15.0	433.0	0.11990	51.9
27	15.0	433.0	0.11051	47.9
28	15.0	433.0	0.10185	44.1
29	15.0	433.0	0.09387	40.6
30	15.0	433.0	0.08652	37.5
31	15.0	433.0	0.07974	34.5
32	15.0	433.0	0.07349	31.8
33	15.0	433.0	0.06774	29.3
34	15.0	433.0	0.06243	27.0
35	15.0	433.0	0.05754	24.9
36	15.0	433.0	0.05303	23.0
37	15.0	433.0	0.04888	21.2
38	15.0	433.0	0.04505	19.5
39	15.0	433.0	0.04152	18.0
40	15.0	433.0	0.03827	16.6
41	15.0	433.0	0.03527	15.3
42	15.0	433.0	0.03251	14.1
43	15.0	433.0	0.02996	13.0
44	15.0	433.0	0.02761	12.0
45	15.0	433.0	0.02545	11.0
46	15.0	433.0	0.02345	10.2
47	15.0	433.0	0.02162	9.4
48	15.0	433.0	0.01992	8.6
49	15.0	433.0	0.01836	8.0
50	15.0	433.0	0.01692	7.3

SUM OF PRESENT WORTHS				3985.0
PARTIAL PAYMENT FACTOR				0.08646

AVERAGE ANNUAL VALUE				344.6

WITH PROJECT CONDITION ($000)

PROJECT YEAR	UPPR RIVER LWD CHNNL DEPTH	PRESENT TRANS COSTS	PRESENT WORTH FACTOR	WORTH VALUE
1	23.0	236.0	0.92166	217.5
2	23.0	236.0	0.84946	200.5
3	23.0	236.0	0.78291	184.8
4	23.0	236.0	0.72157	170.3
5	23.0	236.0	0.66505	157.0
6	23.0	236.0	0.61295	144.7
7	23.0	236.0	0.56493	133.3
8	23.0	236.0	0.52067	122.9
9	23.0	236.0	0.47988	113.3
10	23.0	236.0	0.44229	104.4
11	23.0	236.0	0.40764	96.2
12	23.0	236.0	0.37570	88.7
13	23.0	236.0	0.34627	81.7
14	23.0	236.0	0.31914	75.3
15	23.0	236.0	0.29414	69.4
16	22.3	244.4	0.27110	66.3
17	21.6	254.0	0.24986	63.5
18	20.9	264.7	0.23028	61.0
19	20.2	276.6	0.21224	58.7
20	19.5	290.0	0.19562	56.7
21	18.8	304.8	0.18029	55.0
22	18.1	321.6	0.16617	53.4
23	17.4	341.4	0.15315	52.3
24	16.7	363.8	0.14115	51.4
25	16.0	389.0	0.13009	50.6
26	15.3	419.8	0.11990	50.3
27	15.0	433.0	0.11051	47.9
28	15.0	433.0	0.10185	44.1
29	15.0	433.0	0.09387	40.6
30	15.0	433.0	0.08652	37.5
31	15.0	433.0	0.07974	34.5
32	15.0	433.0	0.07349	31.8
33	15.0	433.0	0.06774	29.3
34	15.0	433.0	0.06243	27.0
35	15.0	433.0	0.05754	24.9
36	15.0	433.0	0.05303	23.0
37	15.0	433.0	0.04888	21.2
38	15.0	433.0	0.04505	19.5
39	15.0	433.0	0.04152	18.0
40	15.0	433.0	0.03827	16.6
41	15.0	433.0	0.03527	15.3
42	15.0	433.0	0.03251	14.1
43	15.0	433.0	0.02996	13.0
44	15.0	433.0	0.02761	12.0
45	15.0	433.0	0.02545	11.0
46	15.0	433.0	0.02345	10.2
47	15.0	433.0	0.02162	9.4
48	15.0	433.0	0.01992	8.6
49	15.0	433.0	0.01836	8.0
50	15.0	433.0	0.01692	7.3

SUM OF PRESENT WORTHS				3,103.5
PARTIAL PAYMENT FACTOR				0.08646

AVERAGE ANNUAL VALUE				268.3

Table B 23G-Annual Transportation Costs- Upper River Limestone: Docks With 1.06 Feet Of shoaling Per Year

WITHOUT PROJECT CONDITION ($000)					WITH PROJECT CONDITION ($000)				
PROJECT YEAR	LWD CHNNL DEPTH	UPPER RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE	PROJECT YEAR	LWD CHNNL DEPTH	UPPER RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE
1	23.0	1641.0	0.92166	1,512.4	1	23.0	1641.0	0.92166	1,512.4
2	21.9	1737.1	0.84946	1,475.6	2	23.0	1641.0	0.84946	1,394.0
3	20.9	1839.6	0.78291	1,440.2	3	23.0	1641.0	0.78291	1,284.8
4	19.8	1971.0	0.72157	1,422.2	4	23.0	1641.0	0.72157	1,184.1
5	18.8	2111.2	0.66505	1,404.0	5	23.0	1641.0	0.66505	1,091.3
6	17.7	2298.2	0.61295	1,408.7	6	23.0	1641.0	0.61295	1,005.8
7	16.6	2529.2	0.56493	1,428.8	7	23.0	1641.0	0.56493	927.0
8	15.6	2791.6	0.52067	1,453.5	8	23.0	1641.0	0.52067	854.4
9	15.0	2971.0	0.47988	1,425.7	9	23.0	1641.0	0.47988	787.5
10	15.0	2971.0	0.44229	1,314.0	10	23.0	1641.0	0.44229	725.8
11	15.0	2971.0	0.40764	1,211.1	11	23.0	1641.0	0.40764	668.9
12	15.0	2971.0	0.37570	1,116.2	12	23.0	1641.0	0.37570	616.5
13	15.0	2971.0	0.34627	1,028.8	13	23.0	1641.0	0.34627	568.2
14	15.0	2971.0	0.31914	948.2	14	23.0	1641.0	0.31914	523.7
15	15.0	2971.0	0.29414	873.9	15	23.0	1641.0	0.29414	482.7
16	15.0	2971.0	0.27110	805.4	16	21.9	1737.1	0.27110	470.9
17	15.0	2971.0	0.24986	742.3	17	20.9	1839.6	0.24986	459.6
18	15.0	2971.0	0.23028	684.2	18	19.8	1971.0	0.23028	453.9
19	15.0	2971.0	0.21224	630.6	19	18.8	2111.2	0.21224	448.1
20	15.0	2971.0	0.19562	581.2	20	17.7	2298.2	0.19562	449.6
21	15.0	2971.0	0.18029	535.6	21	16.6	2529.2	0.18029	456.0
22	15.0	2971.0	0.16617	493.7	22	15.6	2791.6	0.16617	463.9
23	15.0	2971.0	0.15315	455.0	23	15.0	2971.0	0.15315	455.0
24	15.0	2971.0	0.14115	419.4	24	15.0	2971.0	0.14115	419.4
25	15.0	2971.0	0.13009	386.5	25	15.0	2971.0	0.13009	386.5
26	15.0	2971.0	0.11990	356.2	26	15.0	2971.0	0.11990	356.2
27	15.0	2971.0	0.11051	328.3	27	15.0	2971.0	0.11051	328.3
28	15.0	2971.0	0.10185	302.6	28	15.0	2971.0	0.10185	302.6
29	15.0	2971.0	0.09387	278.9	29	15.0	2971.0	0.09387	278.9
30	15.0	2971.0	0.08652	257.0	30	15.0	2971.0	0.08652	257.0
31	15.0	2971.0	0.07974	236.9	31	15.0	2971.0	0.07974	236.9
32	15.0	2971.0	0.07349	218.3	32	15.0	2971.0	0.07349	218.3
33	15.0	2971.0	0.06774	201.2	33	15.0	2971.0	0.06774	201.2
34	15.0	2971.0	0.06243	185.5	34	15.0	2971.0	0.06243	185.5
35	15.0	2971.0	0.05754	170.9	35	15.0	2971.0	0.05754	170.9
36	15.0	2971.0	0.05303	157.6	36	15.0	2971.0	0.05303	157.6
37	15.0	2971.0	0.04888	145.2	37	15.0	2971.0	0.04888	145.2
38	15.0	2971.0	0.04505	133.8	38	15.0	2971.0	0.04505	133.8
39	15.0	2971.0	0.04152	123.4	39	15.0	2971.0	0.04152	123.4
40	15.0	2971.0	0.03827	113.7	40	15.0	2971.0	0.03827	113.7
41	15.0	2971.0	0.03527	104.8	41	15.0	2971.0	0.03527	104.8
42	15.0	2971.0	0.03251	96.6	42	15.0	2971.0	0.03251	96.6
43	15.0	2971.0	0.02996	89.0	43	15.0	2971.0	0.02996	89.0
44	15.0	2971.0	0.02761	82.0	44	15.0	2971.0	0.02761	82.0
45	15.0	2971.0	0.02545	75.6	45	15.0	2971.0	0.02545	75.6
46	15.0	2971.0	0.02345	69.7	46	15.0	2971.0	0.02345	69.7
47	15.0	2971.0	0.02162	64.2	47	15.0	2971.0	0.02162	64.2
48	15.0	2971.0	0.01992	59.2	48	15.0	2971.0	0.01992	59.2
49	15.0	2971.0	0.01836	54.6	49	15.0	2971.0	0.01836	54.6
50	15.0	2971.0	0.01692	50.3	50	15.0	2971.0	0.01692	50.3
				------					------
SUM OF PRESENT WORTHS				29,152.9					22,045.7
PARTIAL PAYMENT FACTOR				0.08646					0.08646
				------					------
AVERAGE ANNUAL VALUE				2,520.7					1,906.1

Table B 24A-Annual Transportation Costs-Old River Canadian Salt: Lake Erie Ports

WITHOUT PROJECT CONDITION ($000)					WITH PROJECT CONDITION ($000)				
PRJCT YEAR	LWD CHNNL DEPTH	LWR RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE	PRJCT YEAR	LWD CHNNL DEPTH	LWR RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE
1	21.0	92.0	0.92166	84.8	1	21.0	92.0	0.92166	84.8
2	20.6	92.4	0.84946	78.5	2	21.0	92.0	0.84946	78.1
3	20.3	92.7	0.78291	72.6	3	21.0	92.0	0.78291	72.0
4	19.9	93.3	0.72157	68.2	4	21.0	92.0	0.72157	66.4
5	19.5	94.5	0.66505	63.6	5	21.0	92.0	0.66505	61.2
6	19.1	95.7	0.61295	58.7	6	21.0	92.0	0.61295	56.4
7	18.8	96.8	0.56493	54.7	7	21.0	92.0	0.56493	52.0
8	18.4	98.4	0.52067	51.2	8	21.0	92.0	0.52067	47.9
9	18.0	100.0	0.47988	48.0	9	21.0	92.0	0.47988	44.1
10	17.7	101.2	0.44229	44.8	10	21.0	92.0	0.44229	40.7
11	17.3	102.8	0.40764	41.9	11	21.0	92.0	0.40764	37.5
12	16.9	104.6	0.37570	39.3	12	21.0	92.0	0.37570	34.6
13	16.6	106.4	0.34627	36.8	13	21.0	92.0	0.34627	31.9
14	16.2	108.8	0.31914	34.7	14	21.0	92.0	0.31914	29.4
15	15.8	111.4	0.29414	32.8	15	21.0	92.0	0.29414	27.1
16	15.4	114.2	0.27110	31.0	16	20.6	92.4	0.27110	25.0
17	15.1	116.3	0.24986	29.1	17	20.3	92.7	0.24986	23.2
18	15.0	117.0	0.23028	26.9	18	19.9	93.3	0.23028	21.5
19	15.0	117.0	0.21224	24.8	19	19.5	94.5	0.21224	20.1
20	15.0	117.0	0.19562	22.9	20	19.1	95.7	0.19562	18.7
21	15.0	117.0	0.18029	21.1	21	18.8	96.8	0.18029	17.5
22	15.0	117.0	0.16617	19.4	22	18.4	98.4	0.16617	16.4
23	15.0	117.0	0.15315	17.9	23	18.0	100.0	0.15315	15.3
24	15.0	117.0	0.14115	16.5	24	17.7	101.2	0.14115	14.3
25	15.0	117.0	0.13009	15.2	25	17.3	102.8	0.13009	13.4
26	15.0	117.0	0.11990	14.0	26	16.9	104.6	0.11990	12.5
27	15.0	117.0	0.11051	12.9	27	16.6	106.4	0.11051	11.8
28	15.0	117.0	0.10185	11.9	28	16.2	108.8	0.10185	11.1
29	15.0	117.0	0.09387	11.0	29	15.8	111.4	0.09387	10.5
30	15.0	117.0	0.08652	10.1	30	15.4	114.2	0.08652	9.9
31	15.0	117.0	0.07974	9.3	31	15.1	116.3	0.07974	9.3
32	15.0	117.0	0.07349	8.6	32	15.0	117.0	0.07349	8.6
33	15.0	117.0	0.06774	7.9	33	15.0	117.0	0.06774	7.9
34	15.0	117.0	0.06243	7.3	34	15.0	117.0	0.06243	7.3
35	15.0	117.0	0.05754	6.7	35	15.0	117.0	0.05754	6.7
36	15.0	117.0	0.05303	6.2	36	15.0	117.0	0.05303	6.2
37	15.0	117.0	0.04888	5.7	37	15.0	117.0	0.04888	5.7
38	15.0	117.0	0.04505	5.3	38	15.0	117.0	0.04505	5.3
39	15.0	117.0	0.04152	4.9	39	15.0	117.0	0.04152	4.9
40	15.0	117.0	0.03827	4.5	40	15.0	117.0	0.03827	4.5
41	15.0	117.0	0.03527	4.1	41	15.0	117.0	0.03527	4.1
42	15.0	117.0	0.03251	3.8	42	15.0	117.0	0.03251	3.8
43	15.0	117.0	0.02996	3.5	43	15.0	117.0	0.02996	3.5
44	15.0	117.0	0.02761	3.2	44	15.0	117.0	0.02761	3.2
45	15.0	117.0	0.02545	3.0	45	15.0	117.0	0.02545	3.0
46	15.0	117.0	0.02345	2.7	46	15.0	117.0	0.02345	2.7
47	15.0	117.0	0.02162	2.5	47	15.0	117.0	0.02162	2.5
48	15.0	117.0	0.01992	2.3	48	15.0	117.0	0.01992	2.3
49	15.0	117.0	0.01836	2.1	49	15.0	117.0	0.01836	2.1
50	15.0	117.0	0.01692	2.0	50	15.0	117.0	0.01692	2.0
				------					------
SUM OF PRESENT WORTHS				1,191					1100.7
PARTIAL PAYMENT FACTOR				0.08646					0.08646
				------					------
AVERAGE ANNUAL VALUE				103.0					95.2

Table B 24B-Annual Transportation Costs-Old River Canadian Salt: Lake Ontario Ports

WITHOUT PROJECT CONDITION ($000)					WITH PROJECT CONDITION ($000)				
PRJCT YEAR	LWR RIVER LWD CHNNL DEPTH	TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE	PRJCT YEAR	LWR RIVER LWD CHNNL DEPTH	TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE
1	21.0	1,299.0	0.92166	1,197.2	1	21.0	1,299.0	0.92166	1197.2
2	20.6	1,315.8	0.84946	1,117.7	2	21.0	1,299.0	0.84946	1103.4
3	20.3	1,328.4	0.78291	1,040.0	3	21.0	1,299.0	0.78291	1017.0
4	19.9	1,348.2	0.72157	993.6	4	21.0	1,299.0	0.72157	937.3
5	19.5	1,377.0	0.66505	934.9	5	21.0	1,299.0	0.66505	863.9
6	19.1	1,405.8	0.61295	861.7	6	21.0	1,299.0	0.61295	796.2
7	18.8	1,432.8	0.56493	809.4	7	21.0	1,299.0	0.56493	733.8
8	18.4	1,472.4	0.52067	766.6	8	21.0	1,299.0	0.52067	676.3
9	18.0	1,512.0	0.47988	725.6	9	21.0	1,299.0	0.47988	623.4
10	17.7	1,548.3	0.44229	684.8	10	21.0	1,299.0	0.44229	574.5
11	17.3	1,596.7	0.40764	650.9	11	21.0	1,299.0	0.40764	529.5
12	16.9	1,647.8	0.37570	619.1	12	21.0	1,299.0	0.37570	488.0
13	16.6	1,692.2	0.34627	586.0	13	21.0	1,299.0	0.34627	449.8
14	16.2	1,751.4	0.31914	558.9	14	21.0	1,299.0	0.31914	414.6
15	15.8	1,818.0	0.29414	534.7	15	21.0	1,299.0	0.29414	382.1
16	15.4	1,892.0	0.27110	512.9	16	20.6	1,315.8	0.27110	356.7
17	15.1	1,947.5	0.24986	486.6	17	20.3	1,328.4	0.24986	331.9
18	15.0	1,966.0	0.23028	452.7	18	19.9	1,348.2	0.23028	310.5
19	15.0	1,966.0	0.21224	417.3	19	19.5	1,377.0	0.21224	292.3
20	15.0	1,966.0	0.19562	384.6	20	19.1	1,405.8	0.19562	275.0
21	15.0	1,966.0	0.18029	354.5	21	18.8	1,432.8	0.18029	258.3
22	15.0	1,966.0	0.16617	326.7	22	18.4	1,472.4	0.16617	244.7
23	15.0	1,966.0	0.15315	301.1	23	18.0	1,512.0	0.15315	231.6
24	15.0	1,966.0	0.14115	277.5	24	17.7	1,548.3	0.14115	218.5
25	15.0	1,966.0	0.13009	255.8	25	17.3	1,596.7	0.13009	207.7
26	15.0	1,966.0	0.11990	235.7	26	16.9	1,647.8	0.11990	197.6
27	15.0	1,966.0	0.11051	217.3	27	16.6	1,692.2	0.11051	187.0
28	15.0	1,966.0	0.10185	200.2	28	16.2	1,751.4	0.10185	178.4
29	15.0	1,966.0	0.09387	184.6	29	15.8	1,818.0	0.09387	170.7
30	15.0	1,966.0	0.08652	170.1	30	15.4	1,892.0	0.08652	163.7
31	15.0	1,966.0	0.07974	156.8	31	15.1	1,947.5	0.07974	155.3
32	15.0	1,966.0	0.07349	144.5	32	15.0	1,966.0	0.07349	144.5
33	15.0	1,966.0	0.06774	133.2	33	15.0	1,966.0	0.06774	133.2
34	15.0	1,966.0	0.06243	122.7	34	15.0	1,966.0	0.06243	122.7
35	15.0	1,966.0	0.05754	113.1	35	15.0	1,966.0	0.05754	113.1
36	15.0	1,966.0	0.05303	104.3	36	15.0	1,966.0	0.05303	104.3
37	15.0	1,966.0	0.04888	96.1	37	15.0	1,966.0	0.04888	96.1
38	15.0	1,966.0	0.04505	88.6	38	15.0	1,966.0	0.04505	88.6
39	15.0	1,966.0	0.04152	81.6	39	15.0	1,966.0	0.04152	81.6
40	15.0	1,966.0	0.03827	75.2	40	15.0	1,966.0	0.03827	75.2
41	15.0	1,966.0	0.03527	69.3	41	15.0	1,966.0	0.03527	69.3
42	15.0	1,966.0	0.03251	63.9	42	15.0	1,966.0	0.03251	63.9
43	15.0	1,966.0	0.02996	58.9	43	15.0	1,966.0	0.02996	58.9
44	15.0	1,966.0	0.02761	54.3	44	15.0	1,966.0	0.02761	54.3
45	15.0	1,966.0	0.02545	50.0	45	15.0	1,966.0	0.02545	50.0
46	15.0	1,966.0	0.02345	46.1	46	15.0	1,966.0	0.02345	46.1
47	15.0	1,966.0	0.02162	42.5	47	15.0	1,966.0	0.02162	42.5
48	15.0	1,966.0	0.01992	39.2	48	15.0	1,966.0	0.01992	39.2
49	15.0	1,966.0	0.01836	36.1	49	15.0	1,966.0	0.01836	36.1
50	15.0	1,966.0	0.01692	33.3	50	15.0	1,966.0	0.01692	33.3
SUM OF PRESENT WORTHS				18,468.3					16019.9
PARTIAL PAYMENT FACTOR				0.08646					0.08646
AVERAGE ANNUAL VALUE				1,596.8					1385.1

Table B 24C-Annual Transportation Costs-Old River Canadian Salt: St Lawrence Ports

WITHOUT PROJECT CONDITION ($000)					WITH PROJECT CONDITION ($000)				
PRJCT YEAR	LWD CHNNL DEPTH	LWR RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE	PROJECT YEAR	LWD CHNNL DEPTH	LWR RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE
1	21.0	1,418.0	0.92166	1,306.9	1	21.0	1,418.0	0.92166	1306.9
2	20.6	1,438.8	0.84946	1,222.2	2	21.0	1,418.0	0.84946	1204.5
3	20.3	1,454.4	0.78291	1,138.7	3	21.0	1,418.0	0.78291	1110.2
4	19.9	1,478.8	0.72157	1,092.5	4	21.0	1,418.0	0.72157	1023.2
5	19.5	1,514.0	0.66505	1,030.3	5	21.0	1,418.0	0.66505	943.0
6	19.1	1,549.2	0.61295	949.6	6	21.0	1,418.0	0.61295	869.2
7	18.8	1,582.2	0.56493	893.8	7	21.0	1,418.0	0.56493	801.1
8	18.4	1,630.6	0.52067	849.0	8	21.0	1,418.0	0.52067	738.3
9	18.0	1,679.0	0.47988	805.7	9	21.0	1,418.0	0.47988	68[illegible]5
10	17.7	1,723.4	0.44229	762.2	10	21.0	1,418.0	0.44229	627.2
11	17.3	1,782.6	0.40764	726.7	11	21.0	1,418.0	0.40764	578.0
12	16.9	1,845.1	0.37570	693.2	12	21.0	1,418.0	0.37570	532.7
13	16.6	1,899.4	0.34627	657.7	13	21.0	1,418.0	0.34627	491.0
14	16.2	1,971.8	0.31914	629.3	14	21.0	1,418.0	0.31914	452.5
15	15.8	2,053.0	0.29414	603.9	15	21.0	1,418.0	0.29414	417.1
16	15.4	2,143.0	0.27110	581.0	16	20.6	1,438.8	0.27110	390.1
17	15.1	2,210.5	0.24986	552.3	17	20.3	1,454.4	0.24986	363.4
18	15.0	2,233.0	0.23028	514.2	18	19.9	1,478.8	0.23028	340.5
19	15.0	2,233.0	0.21224	473.9	19	19.5	1,514.0	0.21224	321.3
20	15.0	2,233.0	0.19562	436.8	20	19.1	1,549.2	0.19562	303.0
21	15.0	2,233.0	0.18029	402.6	21	18.8	1,582.2	0.18029	285.3
22	15.0	2,233.0	0.16617	371.1	22	18.4	1,630.6	0.16617	271.0
23	15.0	2,233.0	0.15315	342.0	23	18.0	1,679.0	0.15315	257.1
24	15.0	2,233.0	0.14115	315.2	24	17.7	1,723.4	0.14115	243.3
25	15.0	2,233.0	0.13009	290.5	25	17.3	1,782.6	0.13009	231.9
26	15.0	2,233.0	0.11990	267.7	26	16.9	1,845.1	0.11990	221.2
27	15.0	2,233.0	0.11051	246.8	27	16.6	1,899.4	0.11051	209.9
28	15.0	2,233.0	0.10185	227.4	28	16.2	1,971.8	0.10185	200.8
29	15.0	2,233.0	0.09387	209.6	29	15.8	2,053.0	0.09387	192.7
30	15.0	2,233.0	0.08652	193.2	30	15.4	2,143.0	0.08652	185.4
31	15.0	2,233.0	0.07974	178.1	31	15.1	2,210.5	0.07974	176.3
32	15.0	2,233.0	0.07349	164.1	32	15.0	2,233.0	0.07349	164.1
33	15.0	2,233.0	0.06774	151.3	33	15.0	2,233.0	0.06774	151.3
34	15.0	2,233.0	0.06243	139.4	34	15.0	2,233.0	0.06243	139.4
35	15.0	2,233.0	0.05754	128.5	35	15.0	2,233.0	0.05754	128.5
36	15.0	2,233.0	0.05303	118.4	36	15.0	2,233.0	0.05303	118.4
37	15.0	2,233.0	0.04888	109.1	37	15.0	2,233.0	0.04888	109.1
38	15.0	2,233.0	0.04505	100.6	38	15.0	2,233.0	0.04505	100.6
39	15.0	2,233.0	0.04152	92.7	39	15.0	2,233.0	0.04152	92.7
40	15.0	2,233.0	0.03827	85.4	40	15.0	2,233.0	0.03827	85.4
41	15.0	2,233.0	0.03527	78.8	41	15.0	2,233.0	0.03527	78.8
42	15.0	2,233.0	0.03251	72.6	42	15.0	2,233.0	0.03251	72.6
43	15.0	2,233.0	0.02996	66.9	43	15.0	2,233.0	0.02996	66.9
44	15.0	2,233.0	0.02761	61.7	44	15.0	2,233.0	0.02761	61.7
45	15.0	2,233.0	0.02545	56.8	45	15.0	2,233.0	0.02545	56.8
46	15.0	2,233.0	0.02345	52.4	46	15.0	2,233.0	0.02345	52.4
47	15.0	2,233.0	0.02162	48.3	47	15.0	2,233.0	0.02162	48.3
48	15.0	2,233.0	0.01992	44.5	48	15.0	2,233.0	0.01992	44.5
49	15.0	2,233.0	0.01836	41.0	49	15.0	2,233.0	0.01836	41.0
50	15.0	2,233.0	0.01692	37.8	50	15.0	2,233.0	0.01692	37.8
				------					------
SUM OF PRESENT WORTHS				20,614.2					17618.9
PARTIAL PAYMENT FACTOR				0.08646					0.08646
				------					------
AVERAGE ANNUAL VALUE				1,782.4					1523.4

Table B 24D-Annual Transportation Costs-Old River U. S. Salt: Lake Michigan Ports

WITHOUT PROJECT CONDITION ($000)					WITH PROJECT CONDITION ($000)				
		OLD RIVER	PRESENT	PRESENT			OLD RIVER	PRESENT	PRESENT
PRJCT	LWD CHNNL	TRANS	WORTH	WORTH	PRJCT	LWD CHNNL	TRANS	WORTH	WORTH
YEAR	DEPTH	COSTS	FACTOR	VALUE	YEAR	DEPTH	COSTS	FACTOR	VALUE
1	21.0	1,879.0	0.92166	1,731.8	1	21.0	1,879.0	0.92166	1731.8
2	20.6	1,899.8	0.84946	1,613.8	2	21.0	1,879.0	0.84946	1596.1
3	20.3	1,915.4	0.78291	1,499.6	3	21.0	1,879.0	0.78291	1471.1
4	19.9	1,941.4	0.72157	1,430.9	4	21.0	1,879.0	0.72157	1355.8
5	19.5	1,983.0	0.66505	1,346.5	5	21.0	1,879.0	0.66505	1249.6
6	19.1	2,024.6	0.61295	1,241.0	6	21.0	1,879.0	0.61295	1151.7
7	18.8	2,063.8	0.56493	1,165.9	7	21.0	1,879.0	0.56493	1061.5
8	18.4	2,121.4	0.52067	1,104.5	8	21.0	1,879.0	0.52067	978.3
9	18.0	2,179.0	0.47988	1,045.7	9	21.0	1,879.0	0.47988	901.7
10	17.7	2,232.1	0.44229	987.2	10	21.0	1,879.0	0.44229	831.1
11	17.3	2,302.9	0.40764	938.7	11	21.0	1,879.0	0.40764	765.9
12	16.9	2,377.6	0.37570	893.3	12	21.0	1,879.0	0.37570	705.9
13	16.6	2,442.4	0.34627	845.7	13	21.0	1,879.0	0.34627	650.6
14	16.2	2,528.8	0.31914	807.0	14	21.0	1,879.0	0.31914	599.7
15	15.8	2,625.0	0.29414	772.1	15	21.0	1,879.0	0.29414	552.7
16	15.4	2,731.0	0.27110	740.4	16	20.6	1,899.8	0.27110	515.0
17	15.1	2,810.5	0.24986	702.2	17	20.3	1,915.4	0.24986	478.6
18	15.0	2,837.0	0.23028	653.3	18	19.9	1,941.4	0.23028	447.1
19	15.0	2,837.0	0.21224	602.1	19	19.5	1,983.0	0.21224	420.9
20	15.0	2,837.0	0.19562	555.0	20	19.1	2,024.6	0.19562	396.0
21	15.0	2,837.0	0.18029	511.5	21	18.8	2,063.8	0.18029	372.1
22	15.0	2,837.0	0.16617	471.4	22	18.4	2,121.4	0.16617	352.5
23	15.0	2,837.0	0.15315	434.5	23	18.0	2,179.0	0.15315	333.7
24	15.0	2,837.0	0.14115	400.4	24	17.7	2,232.1	0.14115	315.1
25	15.0	2,837.0	0.13009	369.1	25	17.3	2,302.9	0.13009	299.6
26	15.0	2,837.0	0.11990	340.2	26	16.9	2,377.6	0.11990	285.1
27	15.0	2,837.0	0.11051	313.5	27	16.6	2,442.4	0.11051	269.9
28	15.0	2,837.0	0.10185	289.0	28	16.2	2,528.8	0.10185	257.6
29	15.0	2,837.0	0.09387	266.3	29	15.8	2,625.0	0.09387	246.4
30	15.0	2,837.0	0.08652	245.5	30	15.4	2,731.0	0.08652	236.3
31	15.0	2,837.0	0.07974	226.2	31	15.1	2,810.5	0.07974	224.1
32	15.0	2,837.0	0.07349	208.5	32	15.0	2,837.0	0.07349	208.5
33	15.0	2,837.0	0.06774	192.2	33	15.0	2,837.0	0.06774	192.2
34	15.0	2,837.0	0.06243	177.1	34	15.0	2,837.0	0.06243	177.1
35	15.0	2,837.0	0.05754	163.2	35	15.0	2,837.0	0.05754	163.2
36	15.0	2,837.0	0.05303	150.4	36	15.0	2,837.0	0.05303	150.4
37	15.0	2,837.0	0.04888	138.7	37	15.0	2,837.0	0.04888	138.7
38	15.0	2,837.0	0.04505	127.8	38	15.0	2,837.0	0.04505	127.8
39	15.0	2,837.0	0.04152	117.8	39	15.0	2,837.0	0.04152	117.8
40	15.0	2,837.0	0.03827	108.6	40	15.0	2,837.0	0.03827	108.6
41	15.0	2,837.0	0.03527	100.1	41	15.0	2,837.0	0.03527	100.1
42	15.0	2,837.0	0.03251	92.2	42	15.0	2,837.0	0.03251	92.2
43	15.0	2,837.0	0.02996	85.0	43	15.0	2,837.0	0.02996	85.0
44	15.0	2,837.0	0.02761	78.3	44	15.0	2,837.0	0.02761	78.3
45	15.0	2,837.0	0.02545	72.2	45	15.0	2,837.0	0.02545	72.2
46	15.0	2,837.0	0.02345	66.5	46	15.0	2,837.0	0.02345	66.5
47	15.0	2,837.0	0.02162	61.3	47	15.0	2,837.0	0.02162	61.3
48	15.0	2,837.0	0.01992	56.5	48	15.0	2,837.0	0.01992	56.5
49	15.0	2,837.0	0.01836	52.1	49	15.0	2,837.0	0.01836	52.1
50	15.0	2,837.0	0.01692	48.0	50	15.0	2,837.0	0.01692	48.0
				------					------
SUM OF PRESENT WORTHS				26,641					23150.2
PARTIAL PAYMENT FACTOR				0.08646					0.08646
				------					------
AVERAGE ANNUAL VALUE				2,303.5					2001.6

Table B 24E-Annual Transportation Costs-Old River U. S. Salt: Lake Huron Ports

WITHOUT PROJECT CONDITION ($000)					WITH PROJECT CONDITION ($000)				
PRJCT YEAR	LWD CHNNL DEPTH	OLD RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE	PRJCT YEAR	LWD CHNNL DEPTH	OLD RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE
1	21.0	178.0	0.92166	164.1	1	21.0	178.0	0.92166	164.1
2	20.6	180.0	0.84946	152.9	2	21.0	178.0	0.84946	151.2
3	20.3	181.5	0.78291	142.1	3	21.0	178.0	0.78291	139.4
4	19.9	183.8	0.72157	134.9	4	21.0	178.0	0.72157	128.4
5	19.5	187.0	0.66505	126.5	5	21.0	178.0	0.66505	118.4
6	19.1	190.2	0.61295	116.6	6	21.0	178.0	0.61295	109.1
7	18.8	193.2	0.56493	109.1	7	21.0	178.0	0.56493	100.6
8	18.4	197.6	0.52067	102.9	8	21.0	178.0	0.52067	92.7
9	18.0	202.0	0.47988	96.9	9	21.0	178.0	0.47988	85.4
10	17.7	206.2	0.44229	91.2	10	21.0	178.0	0.44229	78.7
11	17.3	211.8	0.40764	86.3	11	21.0	178.0	0.40764	72.6
12	16.9	217.7	0.37570	81.8	12	21.0	178.0	0.37570	66.9
13	16.6	222.8	0.34627	77.1	13	21.0	178.0	0.34627	61.6
14	16.2	229.6	0.31914	73.3	14	21.0	178.0	0.31914	56.8
15	15.8	237.0	0.29414	69.7	15	21.0	178.0	0.29414	52.4
16	15.4	245.0	0.27110	66.4	16	20.6	180.0	0.27110	48.8
17	15.1	251.0	0.24986	62.7	17	20.3	181.5	0.24986	45.3
18	15.0	253.0	0.23028	58.3	18	19.9	183.8	0.23028	42.3
19	15.0	253.0	0.21224	53.7	19	19.5	187.0	0.21224	39.7
20	15.0	253.0	0.19562	49.5	20	19.1	190.2	0.19562	37.2
21	15.0	253.0	0.18029	45.6	21	18.8	193.2	0.18029	34.8
22	15.0	253.0	0.16617	42.0	22	18.4	197.6	0.16617	32.8
23	15.0	253.0	0.15315	38.7	23	18.0	202.0	0.15315	30.9
24	15.0	253.0	0.14115	35.7	24	17.7	206.2	0.14115	29.1
25	15.0	253.0	0.13009	32.9	25	17.3	211.8	0.13009	27.6
26	15.0	253.0	0.11990	30.3	26	16.9	217.7	0.11990	26.1
27	15.0	253.0	0.11051	28.0	27	16.6	222.8	0.11051	24.6
28	15.0	253.0	0.10185	25.8	28	16.2	229.6	0.10185	23.4
29	15.0	253.0	0.09387	23.7	29	15.8	237.0	0.09387	22.2
30	15.0	253.0	0.08652	21.9	30	15.4	245.0	0.08652	21.2
31	15.0	253.0	0.07974	20.2	31	15.1	251.0	0.07974	20.0
32	15.0	253.0	0.07349	18.6	32	15.0	253.0	0.07349	18.6
33	15.0	253.0	0.06774	17.1	33	15.0	253.0	0.06774	17.1
34	15.0	253.0	0.06243	15.8	34	15.0	253.0	0.06243	15.8
35	15.0	253.0	0.05754	14.6	35	15.0	253.0	0.05754	14.6
36	15.0	253.0	0.05303	13.4	36	15.0	253.0	0.05303	13.4
37	15.0	253.0	0.04888	12.4	37	15.0	253.0	0.04888	12.4
38	15.0	253.0	0.04505	11.4	38	15.0	253.0	0.04505	11.4
39	15.0	253.0	0.04152	10.5	39	15.0	253.0	0.04152	10.5
40	15.0	253.0	0.03827	9.7	40	15.0	253.0	0.03827	9.7
41	15.0	253.0	0.03527	8.9	41	15.0	253.0	0.03527	8.9
42	15.0	253.0	0.03251	8.2	42	15.0	253.0	0.03251	8.2
43	15.0	253.0	0.02996	7.6	43	15.0	253.0	0.02996	7.6
44	15.0	253.0	0.02761	7.0	44	15.0	253.0	0.02761	7.0
45	15.0	253.0	0.02545	6.4	45	15.0	253.0	0.02545	6.4
46	15.0	253.0	0.02345	5.9	46	15.0	253.0	0.02345	5.9
47	15.0	253.0	0.02162	5.5	47	15.0	253.0	0.02162	5.5
48	15.0	253.0	0.01992	5.0	48	15.0	253.0	0.01992	5.0
49	15.0	253.0	0.01836	4.6	49	15.0	253.0	0.01836	4.6
50	15.0	253.0	0.01692	4.3	50	15.0	253.0	0.01692	4.3
				------					------
SUM OF PRESENT WORTHS				2,447.9					2171.3
PARTIAL PAYMENT FACTOR				0.08646					0.08646
				------					------
AVERAGE ANNUAL VALUE				211.7					187.7

Table B 24F-Annual Transportation Costs--Old River U. S. Salt: Detroit River Ports

WITHOUT PROJECT CONDITION ($000)					WITH PROJECT CONDITION ($000)				
PRJCT YEAR	LWD CHNNL DEPTH	OLD RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE	PROJECT YEAR	LWD CHNNL DEPTH	OLD RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE
1	21.0	360.0	0.92166	331.8	1	21.0	360.0	0.92166	331.8
2	20.6	362.8	0.84946	308.2	2	21.0	360.0	0.84946	305.8
3	20.3	364.9	0.78291	285.7	3	21.0	360.0	0.78291	281.8
4	19.9	368.1	0.72157	268.8	4	21.0	360.0	0.72157	259.8
5	19.5	372.5	0.66505	250.7	5	21.0	360.0	0.66505	239.4
6	19.1	376.9	0.61295	231.0	6	21.0	360.0	0.61295	220.7
7	18.8	381.2	0.56493	215.3	7	21.0	360.0	0.56493	203.4
8	18.4	387.6	0.52067	201.8	8	21.0	360.0	0.52067	187.4
9	18.0	394.0	0.47988	189.1	9	21.0	360.0	0.47988	172.8
10	17.7	399.4	0.44229	176.6	10	21.0	360.0	0.44229	159.2
11	17.3	406.6	0.40764	165.7	11	21.0	360.0	0.40764	146.7
12	16.9	414.3	0.37570	155.7	12	21.0	360.0	0.37570	135.3
13	16.6	421.2	0.34627	145.8	13	21.0	360.0	0.34627	124.7
14	16.2	430.4	0.31914	137.4	14	21.0	360.0	0.31914	114.9
15	15.8	440.6	0.29414	129.6	15	21.0	360.0	0.29414	105.9
16	15.4	451.8	0.27110	122.5	16	20.6	362.8	0.27110	98.4
17	15.1	460.2	0.24986	115.0	17	20.3	364.9	0.24986	91.2
18	15.0	463.0	0.23028	106.6	18	19.9	368.1	0.23028	84.8
19	15.0	463.0	0.21224	98.3	19	19.5	372.5	0.21224	79.1
20	15.0	463.0	0.19562	90.6	20	19.1	376.9	0.19562	73.7
21	15.0	463.0	0.18029	83.5	21	18.8	381.2	0.18029	68.7
22	15.0	463.0	0.16617	76.9	22	18.4	387.6	0.16617	64.4
23	15.0	463.0	0.15315	70.9	23	18.0	394.0	0.15315	60.3
24	15.0	463.0	0.14115	65.	24	17.7	399.4	0.14115	56.4
25	15.0	463.0	0.13009	60.2	25	17.3	406.6	0.13009	52.9
26	15.0	463.0	0.11990	55.5	26	16.9	414.3	0.11990	49.7
27	15.0	463.0	0.11051	51.2	27	16.6	421.2	0.11051	46.5
28	15.0	463.0	0.10185	47.2	28	16.2	430.4	0.10185	43.8
29	15.0	463.0	0.09387	43.5	29	15.8	440.6	0.09387	41.4
30	15.0	463.0	0.08652	40.1	30	15.4	451.8	0.08652	39.1
31	15.0	463.0	0.07974	36.9	31	15.1	460.2	0.07974	36.7
32	15.0	463.0	0.07349	34.0	32	15.0	463.0	0.07349	34.0
33	15.0	463.0	0.06774	31.4	33	15.0	463.0	0.06774	31.4
34	15.0	463.0	0.06243	28.9	34	15.0	463.0	0.06243	28.9
35	15.0	463.0	0.05754	26.6	35	15.0	463.0	0.05754	26.6
36	15.0	463.0	0.05303	24.6	36	15.0	463.0	0.05303	24.6
37	15.0	463.0	0.04888	22.6	37	15.0	463.0	0.04888	22.6
38	15.0	463.0	0.04505	20.9	38	15.0	463.0	0.04505	20.9
39	15.0	463.0	0.04152	19.2	39	15.0	463.0	0.04152	19.2
40	15.0	463.0	0.03827	17.7	40	15.0	463.0	0.03827	17.7
41	15.0	463.0	0.03527	16.3	41	15.0	463.0	0.03527	16.3
42	15.0	463.0	0.03251	15.0	42	15.0	463.0	0.03251	15.0
43	15.0	463.0	0.02996	13.9	43	15.0	463.0	0.02996	13.9
44	15.0	463.0	0.02761	12.8	44	15.0	463.0	0.02761	12.8
45	15.0	463.0	0.02545	11.8	45	15.0	463.0	0.02545	11.8
46	15.0	463.0	0.02345	10.9	46	15.0	463.0	0.02345	10.9
47	15.0	463.0	0.02162	10.0	47	15.0	463.0	0.02162	10.0
48	15.0	463.0	0.01992	9.2	48	15.0	463.0	0.01992	9.2
49	15.0	463.0	0.01836	8.5	49	15.0	463.0	0.01836	8.5
50	15.0	463.0	0.01692	7.8	50	15.0	463.0	0.01692	7.8
				------					------
SUM OF PRESENT WORTHS				4,699.5					4318.7
PARTIAL PAYMENT FACTOR				0.08646					0.08646
				------					------
AVERAGE ANNUAL VALUE				406.3					373.4

Table B 24G-Annual Transportation Costs-Old River U. S. Salt: Lake Erie Ports

WITHOUT PROJECT CONDITION ($000)					WITH PROJECT CONDITION ($000)				
		OLD RIVER	PRESENT	PRESENT			OLD RIVER	PRESENT	PRESENT
PRJCT	LWD CHNNL	TRANS	WORTH	WORTH	PROJECT	LWD CHNNL	TRANS	WORTH	WORTH
YEAR	DEPTH	COSTS	FACTOR	VALUE	YEAR	DEPTH	COSTS	FACTOR	VALUE
1	21.0	125.0	0.92166	115.2	1	21.0	125.0	0.92166	115.2
2	20.6	126.2	0.84946	107.2	2	21.0	125.0	0.84946	106.2
3	20.3	127.1	0.78291	99.5	3	21.0	125.0	0.78291	97.9
4	19.9	128.4	0.72157	93.8	4	21.0	125.0	0.72157	90.2
5	19.5	130.0	0.66505	87.5	5	21.0	125.0	0.66505	83.1
6	19.1	131.6	0.61295	80.7	6	21.0	125.0	0.61295	76.6
7	18.8	133.2	0.56493	75.2	7	21.0	125.0	0.56493	70.6
8	18.4	135.6	0.52067	70.6	8	21.0	125.0	0.52067	65.1
9	18.0	138.0	0.47988	66.2	9	21.0	125.0	0.47988	60.0
10	17.7	140.1	0.44229	62.0	10	21.0	125.0	0.44229	55.3
11	17.3	142.9	0.40764	58.3	11	21.0	125.0	0.40764	51.0
12	16.9	145.8	0.37570	54.8	12	21.0	125.0	0.37570	47.0
13	16.6	148.2	0.34627	51.3	13	21.0	125.0	0.34627	43.3
14	16.2	151.4	0.31914	48.3	14	21.0	125.0	0.31914	39.9
15	15.8	155.2	0.29414	45.7	15	21.0	125.0	0.29414	36.8
16	15.4	159.6	0.27110	43.3	16	20.6	126.2	0.27110	34.2
17	15.1	162.9	0.24986	40.7	17	20.3	127.1	0.24986	31.8
18	15.0	164.0	0.23028	37.8	18	19.9	128.4	0.23028	29.6
19	15.0	164.0	0.21224	34.8	19	19.5	130.0	0.21224	27.6
20	15.0	164.0	0.19562	32.1	20	19.1	131.6	0.19562	25.7
21	15.0	164.0	0.18029	29.6	21	18.8	133.2	0.18029	24.0
22	15.0	164.0	0.16617	27.3	22	18.4	135.6	0.16617	22.5
23	15.0	164.0	0.15315	25.1	23	18.0	138.0	0.15315	21.1
24	15.0	164.0	0.14115	23.1	24	17.7	140.1	0.14115	19.8
25	15.0	164.0	0.13009	21.3	25	17.3	142.9	0.13009	18.6
26	15.0	164.0	0.11990	19.7	26	16.9	145.8	0.11990	17.5
27	15.0	164.0	0.11051	18.1	27	16.6	148.2	0.11051	16.4
28	15.0	164.0	0.10185	16.7	28	16.2	151.4	0.10185	15.4
29	15.0	164.0	0.09387	15.4	29	15.8	155.2	0.09387	14.6
30	15.0	164.0	0.08652	14.2	30	15.4	159.6	0.08652	13.8
31	15.0	164.0	0.07974	13.1	31	15.1	162.9	0.07974	13.0
32	15.0	164.0	0.07349	12.1	32	15.0	164.0	0.07349	12.1
33	15.0	164.0	0.06774	11.1	33	15.0	164.0	0.06774	11.1
34	15.0	164.0	0.06243	10.2	34	15.0	164.0	0.06243	10.2
35	15.0	164.0	0.05754	9.4	35	15.0	164.0	0.05754	9.4
36	15.0	164.0	0.05303	8.7	36	15.0	164.0	0.05303	8.7
37	15.0	164.0	0.04888	8.0	37	15.0	164.0	0.04888	8.0
38	15.0	164.0	0.04505	7.4	38	15.0	164.0	0.04505	7.4
39	15.0	164.0	0.04152	6.8	39	15.0	164.0	0.04152	6.8
40	15.0	164.0	0.03827	6.3	40	15.0	164.0	0.03827	6.3
41	15.0	164.0	0.03527	5.8	41	15.0	164.0	0.03527	5.8
42	15.0	164.0	0.03251	5.3	42	15.0	164.0	0.03251	5.3
43	15.0	164.0	0.02996	4.9	43	15.0	164.0	0.02996	4.9
44	15.0	164.0	0.02761	4.5	44	15.0	164.0	0.02761	4.5
45	15.0	164.0	0.02545	4.2	45	15.0	164.0	0.02545	4.2
46	15.0	164.0	0.02345	3.8	46	15.0	164.0	0.02345	3.8
47	15.0	164.0	0.02162	3.5	47	15.0	164.0	0.02162	3.5
48	15.0	164.0	0.01992	3.3	48	15.0	164.0	0.01992	3.3
49	15.0	164.0	0.01836	3.0	49	15.0	164.0	0.01836	3.0
50	15.0	164.0	0.01692	2.8	50	15.0	164.0	0.01692	2.8
				------					------
SUM OF PRESENT WORTHS				1649.7					1504.8
PARTIAL PAYMENT FACTOR				0.08646					0.08646
				------					------
AVERAGE ANNUAL VALUE				142.6					130.1

Table B 24H-Annual Transportation Costs-Old River U. S. Salt: St Lawrence Ports

WITHOUT PROJECT CONDITION ($000)					WITH PROJECT CONDITION ($000)				
PRJCT YEAR	LWD CHNNL DEPTH	OLD RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE	PROJECT YEAR	LWD CHNNL DEPTH	OLD RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE
1	21.0	309.0	0.92166	284.8	1	21.0	309.0	0.92166	284.8
2	20.6	313.8	0.84946	266.6	2	21.0	309.0	0.84946	262.5
3	20.3	317.4	0.78291	248.5	3	21.0	309.0	0.78291	241.9
4	19.9	322.8	0.72157	238.1	4	21.0	309.0	0.72157	223.0
5	19.5	330.0	0.66505	224.3	5	21.0	309.0	0.66505	205.5
6	19.1	337.2	0.61295	206.7	6	21.0	309.0	0.61295	189.4
7	18.8	344.0	0.56493	194.3	7	21.0	309.0	0.56493	174.6
8	18.4	354.0	0.52067	184.3	8	21.0	309.0	0.52067	160.9
9	18.0	364.0	0.47988	174.7	9	21.0	309.0	0.47988	148.3
10	17.7	373.3	0.44229	165.1	10	21.0	309.0	0.44229	136.7
11	17.3	385.7	0.40764	157.2	11	21.0	309.0	0.40764	126.0
12	16.9	398.7	0.37570	149.8	12	21.0	309.0	0.37570	116.1
13	16.6	409.8	0.34627	141.9	13	21.0	309.0	0.34627	107.0
14	16.2	424.6	0.31914	135.5	14	21.0	309.0	0.31914	98.6
15	15.8	441.2	0.29414	129.8	15	21.0	309.0	0.29414	90.9
16	15.4	459.6	0.27110	124.6	16	20.6	313.8	0.27110	85.1
17	15.1	473.4	0.24986	118.3	17	20.3	317.4	0.24986	79.3
18	15.0	478.0	0.23028	110.1	18	19.9	322.8	0.23028	74.3
19	15.0	478.0	0.21224	101.5	19	19.5	330.0	0.21224	70.0
20	15.0	478.0	0.19562	93.5	20	19.1	337.2	0.19562	66.0
21	15.0	478.0	0.18029	86.2	21	18.8	344.0	0.18029	62.0
22	15.0	478.0	0.16617	79.4	22	18.4	354.0	0.16617	58.8
23	15.0	478.0	0.15315	73.2	23	18.0	364.0	0.15315	55.7
24	15.0	478.0	0.14115	67.5	24	17.7	373.3	0.14115	52.7
25	15.0	478.0	0.13009	62.2	25	17.3	385.7	0.13009	50.2
26	15.0	478.0	0.11990	57.3	26	16.9	398.7	0.11990	47.8
27	15.0	478.0	0.11051	52.8	27	16.6	409.8	0.11051	45.3
28	15.0	478.0	0.10185	48.7	28	16.2	424.6	0.10185	43.2
29	15.0	478.0	0.09387	44.9	29	15.8	441.2	0.09387	41.4
30	15.0	478.0	0.08652	41.4	30	15.4	459.6	0.08652	39.8
31	15.0	478.0	0.07974	38.1	31	15.1	473.4	0.07974	37.7
32	15.0	478.0	0.07349	35.1	32	15.0	478.0	0.07349	35.1
33	15.0	478.0	0.06774	32.4	33	15.0	478.0	0.06774	32.4
34	15.0	478.0	0.06243	29.8	34	15.0	478.0	0.06243	29.8
35	15.0	478.0	0.05754	27.5	35	15.0	478.0	0.05754	27.5
36	15.0	478.0	0.05303	25.3	36	15.0	478.0	0.05303	25.3
37	15.0	478.0	0.04888	23.4	37	15.0	478.0	0.04888	23.4
38	15.0	478.0	0.04505	21.5	38	15.0	478.0	0.04505	21.5
39	15.0	478.0	0.04152	19.8	39	15.0	478.0	0.04152	19.8
40	15.0	478.0	0.03827	18.3	40	15.0	478.0	0.03827	18.3
41	15.0	478.0	0.03527	16.9	41	15.0	478.0	0.03527	16.9
42	15.0	478.0	0.03251	15.5	42	15.0	478.0	0.03251	15.5
43	15.0	478.0	0.02996	14.3	43	15.0	478.0	0.02996	14.3
44	15.0	478.0	0.02761	13.2	44	15.0	478.0	0.02761	13.2
45	15.0	478.0	0.02545	12.2	45	15.0	478.0	0.02545	12.2
46	15.0	478.0	0.02345	11.2	46	15.0	478.0	0.02345	11.2
47	15.0	478.0	0.02162	10.3	47	15.0	478.0	0.02162	10.3
48	15.0	478.0	0.01992	9.5	48	15.0	478.0	0.01992	9.5
49	15.0	478.0	0.01836	8.8	49	15.0	478.0	0.01836	8.8
50	15.0	478.0	0.01692	8.1	50	15.0	478.0	0.01692	8.1
				------					------
SUM OF PRESENT WORTHS				4454.3					3828.7
PARTIAL PAYMENT FACTOR				0.08646					0.08646
				------					------
AVERAGE ANNUAL VALUE				385.1					331.0

Table B 25A-Annual Transportation Costs-Old River/Cuyahoga River U.S. Cement- Docks With .37 Feet Of Shcaling Per Year

WITHOUT PROJECT CONDITION ($000)

PROJECT YEAR	LWD CHNNL DEPTH	LOWER RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE
1	23.0	2,525.0	0.92166	2327.2
2	22.6	2,537.4	0.84946	2155.4
3	22.3	2,546.7	0.78291	1993.8
4	21.9	2,562.4	0.72157	1867.4
5	21.5	2,588.0	0.66505	1738.2
6	21.1	2,613.6	0.61295	1602.0
7	20.8	2,642.6	0.56493	1492.9
8	20.4	2,687.8	0.52067	1399.5
9	20.0	2,733.0	0.47988	1311.5
10	19.7	2,783.7	0.44229	1231.2
11	19.3	2,851.3	0.40764	1162.3
12	18.9	2,924.1	0.37570	1098.6
13	18.6	2,990.4	0.34627	1035.5
14	18.2	3,078.8	0.31914	982.6
15	17.8	3,178.4	0.29414	934.9
16	17.4	3,289.2	0.27110	891.7
17	17.1	3,372.3	0.24986	842.6
18	16.7	3,506.2	0.23028	807.4
19	16.3	3,647.8	0.21224	774.2
20	16.0	3,754.0	0.19562	734.3
21	15.6	3,942.0	0.18029	710.7
22	15.2	4,130.0	0.16617	686.3
23	15.0	4,130.0	0.15315	632.5
24	15.0	4,130.0	0.14115	583.0
25	15.0	4,130.0	0.13009	537.3
26	15.0	4,130.0	0.11990	495.2
27	15.0	4,130.0	0.11051	456.4
28	15.0	4,130.0	0.10185	420.6
29	15.0	4,130.0	0.09387	387.7
30	15.0	4,130.0	0.08652	357.3
31	15.0	4,130.0	0.07974	329.3
32	15.0	4,130.0	0.07349	303.5
33	15.0	4,130.0	0.06774	279.7
34	15.0	4,130.0	0.06243	257.8
35	15.0	4,130.0	0.05754	237.6
36	15.0	4,130.0	0.05303	219.0
37	15.0	4,130.0	0.04888	201.9
38	15.0	4,130.0	0.04505	186.0
39	15.0	4,130.0	0.04152	171.5
40	15.0	4,130.0	0.03827	158.0
41	15.0	4,130.0	0.03527	145.7
42	15.0	4,130.0	0.03251	134.2
43	15.0	4,130.0	0.02996	123.7
44	15.0	4,130.0	0.02761	114.0
45	15.0	4,130.0	0.02545	105.1
46	15.0	4,130.0	0.02345	96.9
47	15.0	4,130.0	0.02162	89.3
48	15.0	4,130.0	0.01992	82.3
49	15.0	4,130.0	0.01836	75.8
50	15.0	4,130.0	0.01692	69.9

SUM OF PRESENT WORTHS				35031.6
PARTIAL PAYMENT FACTOR				0.08646

AVERAGE ANNUAL VALUE				3,028.9

WITH PROJECT CONDITION ($000)

PROJECT YEAR	LWD CHNNL DEPTH	LOWER RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE
1	23.0	2,525.0	0.92166	2327.2
2	23.0	2,525.0	0.84946	2144.9
3	23.0	2,525.0	0.78291	1976.8
4	23.0	2,525.0	0.72157	1822.0
5	23.0	2,525.0	0.66505	1679.2
6	23.0	2,525.0	0.61295	1547.7
7	23.0	2,525.0	0.56493	1426.4
8	23.0	2,525.0	0.52067	1314.7
9	23.0	2,525.0	0.47988	1211.7
10	23.0	2,525.0	0.44229	1116.8
11	23.0	2,525.0	0.40764	1029.3
12	23.0	2,525.0	0.37570	948.6
13	23.0	2,525.0	0.34627	874.3
14	23.0	2,525.0	0.31914	805.8
15	23.0	2,525.0	0.29414	742.7
16	22.6	2,537.4	0.27110	687.9
17	22.3	2,546.7	0.24986	636.3
18	21.9	2,562.4	0.23028	590.1
19	21.5	2,588.0	0.21224	549.3
20	21.1	2,613.6	0.19562	511.3
21	20.8	2,642.6	0.18029	476.4
22	20.4	2,687.8	0.16617	446.6
23	20.0	2,733.0	0.15315	418.6
24	19.7	2,783.7	0.14115	392.9
25	19.3	2,851.3	0.13009	370.9
26	18.9	2,924.1	0.11990	350.6
27	18.6	2,990.4	0.11051	330.5
28	18.2	3,078.8	0.10185	313.6
29	17.8	3,178.4	0.09387	298.4
30	17.4	3,289.2	0.08652	284.6
31	17.1	3,372.3	0.07974	268.9
32	16.7	3,506.2	0.07349	257.7
33	16.3	3,647.8	0.06774	247.1
34	16.0	3,754.0	0.06243	234.4
35	15.6	3,942.0	0.05754	226.8
36	15.2	4,130.0	0.05303	219.0
37	15.0	4,130.0	0.04888	201.9
38	15.0	4,130.0	0.04505	186.0
39	15.0	4,130.0	0.04152	171.5
40	15.0	4,130.0	0.03827	158.0
41	15.0	4,130.0	0.03527	145.7
42	15.0	4,130.0	0.03251	134.2
43	15.0	4,130.0	0.02996	123.7
44	15.0	4,130.0	0.02761	114.0
45	15.0	4,130.0	0.02545	105.1
46	15.0	4,130.0	0.02345	96.9
47	15.0	4,130.0	0.02162	89.3
48	15.0	4,130.0	0.01992	82.3
49	15.0	4,130.0	0.01836	75.8
50	15.0	4,130.0	0.01692	69.9

				30834.3
				0.08646

				2666.0

Table B 25B-Annual Transportation Costs-Old River/Cuyahoga River Canadian Cement- Docks With .37 Feet Of Shoaling Per Year

WITHOUT PROJECT CONDITION ($000)

PROJECT YEAR	LWD CHNNL DEPTH	LOWER RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE
1	23.0	488.0	0.92166	449.8
2	22.6	496.8	0.84946	422.0
3	22.3	503.4	0.78291	394.1
4	21.9	512.4	0.72157	376.7
5	21.5	522.0	0.66505	353.5
6	21.1	531.6	0.61295	325.8
7	20.8	539.6	0.56493	304.8
8	20.4	550.8	0.52067	286.8
9	20.0	562.0	0.47988	269.7
10	19.7	571.6	0.44229	252.8
11	19.3	584.4	0.40764	238.2
12	18.9	597.8	0.37570	224.6
13	18.6	609.2	0.34627	210.9
14	18.2	624.4	0.31914	199.3
15	17.8	641.0	0.29414	188.5
16	17.4	659.0	0.27110	178.7
17	17.1	672.5	0.24986	168.0
18	16.7	693.2	0.23028	159.6
19	16.3	714.8	0.21224	151.7
20	16.0	731.0	0.19562	143.0
21	15.6	757.4	0.18029	136.6
22	15.2	783.8	0.16617	130.2
23	15.0	783.8	0.15315	120.0
24	15.0	783.8	0.14115	110.6
25	15.0	783.8	0.13009	102.0
26	15.0	783.8	0.11990	94.0
27	15.0	783.8	0.11051	86.6
28	15.0	783.8	0.10185	79.8
29	15.0	783.8	0.09387	73.6
30	15.0	783.8	0.08652	67.8
31	15.0	783.8	0.07974	62.5
32	15.0	783.8	0.07349	57.6
33	15.0	783.8	0.06774	53.1
34	15.0	783.8	0.06243	48.9
35	15.0	783.8	0.05754	45.1
36	15.0	783.8	0.05303	41.6
37	15.0	783.8	0.04888	38.3
38	15.0	783.8	0.04505	35.3
39	15.0	783.8	0.04152	32.5
40	15.0	783.8	0.03827	30.0
41	15.0	783.8	0.03527	27.6
42	15.0	783.8	0.03251	25.5
43	15.0	783.8	0.02996	23.5
44	15.0	783.8	0.02761	21.6
45	15.0	783.8	0.02545	19.9
46	15.0	783.8	0.02345	18.4
47	15.0	783.8	0.02162	16.9
48	15.0	783.8	0.01992	15.6
49	15.0	783.8	0.01836	14.4
50	15.0	783.8	0.01692	13.3

SUM OF PRESENT WORTHS				6941.7
PARTIAL PAYMENT FACTOR				0.08646

AVERAGE ANNUAL VALUE				600.2

WITH PROJECT CONDITION ($000)

PROJECT YEAR	LWD CHNNL DEPTH	LOWER RIVER TRANS COSTS	PRESENT WORTH FACTOR	PRESENT WORTH VALUE
1	23.0	488.0	0.92166	449.8
2	23.0	488.0	0.84946	414.5
3	23.0	488.0	0.78291	382.1
4	23.0	488.0	0.72157	352.1
5	23.0	488.0	0.66505	324.5
6	23.0	488.0	0.61295	299.1
7	23.0	488.0	0.56493	275.7
8	23.0	488.0	0.52067	254.1
9	23.0	488.0	0.47988	234.2
10	23.0	488.0	0.44229	215.8
11	23.0	488.0	0.40764	198.9
12	23.0	488.0	0.37570	183.3
13	23.0	488.0	0.34627	169.0
14	23.0	488.0	0.31914	155.7
15	23.0	488.0	0.29414	143.5
16	22.6	496.8	0.27110	134.7
17	22.3	503.4	0.24986	125.8
18	21.9	512.4	0.23028	118.0
19	21.5	522.0	0.21224	110.8
20	21.1	531.6	0.19562	104.0
21	20.8	539.6	0.18029	97.3
22	20.4	550.8	0.16617	91.5
23	20.0	562.0	0.15315	86.1
24	19.7	571.6	0.14115	80.7
25	19.3	584.4	0.13009	76.0
26	18.9	597.8	0.11990	71.7
27	18.6	609.2	0.11051	67.3
28	18.2	624.4	0.10185	63.6
29	17.8	641.0	0.09387	60.2
30	17.4	659.0	0.08652	57.0
31	17.1	672.5	0.07974	53.6
32	16.7	693.2	0.07349	50.9
33	16.3	714.8	0.06774	48.4
34	16.0	731.0	0.06243	45.6
35	15.6	757.4	0.05754	43.6
36	15.2	783.8	0.05303	41.6
37	15.0	783.8	0.04888	38.3
38	15.0	783.8	0.04505	35.3
39	15.0	783.8	0.04152	32.5
40	15.0	783.8	0.03827	30.0
41	15.0	783.8	0.03527	27.6
42	15.0	783.8	0.03251	25.5
43	15.0	783.8	0.02996	23.5
44	15.0	783.8	0.02761	21.6
45	15.0	783.8	0.02545	19.9
46	15.0	783.8	0.02345	18.4
47	15.0	783.8	0.02162	16.9
48	15.0	783.8	0.01992	15.6
49	15.0	783.8	0.01836	14.4
50	15.0	783.8	0.01692	13.3

				6013.8
				0.08646

				520.0

c. <u>Average Annual Transportation Benefits.</u>

The difference in average annual transportation costs between the "Without Project" and "With Project" condition are the benefits attributable to implementation of the new dike disposal facility (Table B26.) Benefits have been aggregated by Harbor area: Outer Harbor, Lower River/Old River, Middle River and Upper River. Total Average Annual Benefits for the four major bulk commodities are $7,896,500. These average annual benefits reflect August 1991 price levels.

Table B26- Average Annual Transportation Benefits For Site 10B- Iron Ore, Limestone, Salt And Cement

	OUTER HARBOR ($000)	LOWER RIVER ($000)	MIDDLE RIVER ($000)	UPPER RIVER ($000)	TOTAL BENEFITS ($000)
IRON ORE BENEFITS					
WITHOUT PROJECT AVERAGE ANNUAL TRANSPORTATION COSTS	21,380.9	631.0		7,765.3	29,697.2
WITH PROJECT AVERAGE ANNUAL TRANSPORTATION COSTS	19,044.4	559.5		6,170.2	25,774.1
	--------	-------	-------	-------	--------
	2,336.5	71.5		1,515.1	3,923.1
LIMESTONE BENEFITS					
WITHOUT PROJECT AVERAGE ANNUAL TRANSPORTATION COSTS		8,139.0	4,048.1	2,865.2	15,052.3
WITH PROJECT AVERAGE ANNUAL TRANSPORTATION COSTS		6,795.0	3,459.5	2,174.5	12,429.0
	--------	-------	-------	-------	--------
		1,344.0	588.6	690.7	2,623.3
SALT BENEFITS					
CANADIAN					
WITHOUT PROJECT ANNUAL TRANSPORTATION COSTS		3,482.2			3,482.2
WITH PROJECT ANNUAL TRANSPORTATION COSTS		3,003.7			3,007.3
	--------	-------	-------	-------	--------
		478.5			478.5
DOMESTIC					
WITHOUT PROJECT ANNUAL TRANSPORTATION COSTS		3,449.2			3,449.2
WITH PROJECT ANNUAL TRANSPORTATION COSTS		3,023.8			3,023.8
	--------	-------	-------	-------	--------
		428.5			428.5
CEMENT BENEFITS					
CANADIAN					
WITHOUT PROJECT ANNUAL TRANSPORTATION COSTS		600.2			600.2
WITH PROJECT ANNUAL TRANSPORTATION COSTS		520.0			520.0
	--------	-------	-------	-------	--------
		80.2			80.2
DOMESTIC					
WITHOUT PROJECT ANNUAL TRANSPORTATION COSTS		3,028.9			3,028.9
WITH PROJECT ANNUAL TRANSPORTATION COSTS		2,666.0			2,666.0
	--------	-------	-------	-------	--------
		362.9			362.9
TOTAL BENEFITS					
IRON ORE	2,336.5	71.5		1,515.1	3,923.1
LIMESTONE		1,344.0	588.6	690.7	2,623.3
SALT		907.0			907.0
CEMENT		443.1			443.1
	--------	-------	-------	-------	--------
	2,336.5	2,765.6	588.6	2,205.8	7,896.5

B4 AVERAGE ANNUAL COSTS

a. Average Annual Construction Costs.

Average annual dike construction costs were developed for site 10 B. (Table B 27). Project first costs included such components as rubblemound dike wall, clay closure wall, and storm sewer modifications. Also included in first costs were lands; planning, engineering and design; construction management and Contingency costs. Construction costs were $32,880,000. These construction costs reflect August 1991 price levels.

Interest During Construction (IDC) was calculated based on an annual interest rate of 8.50 percent, a three year construction length and monthly compounding. IDC was calculated on project first costs after subtracting out Land costs. IDC was added to plan first costs to arrive at plan investment costs.

Table B 27- Summary Of Average Annual Costs-Site 10B.

	Site 10 B- 15 Year Life
CDF Construction	$28,900,000
Sewer Extensions	$ 3,980,000
Total First Cost Of Construction (1)	$32,880,000
Interest During Construction (2)	$ 4,544,500
Total Investment Cost	$37,424,500
Average Annual Costs	
Interest (3)	$ 3,181,100
Amortization (3)	$ 54,800
Annual Dike Maintenance	$ 20,000
Average Annual Dredging Costs	$ 1,155,900
Total Average Annual Costs	$ 4,411,800

(1) Total First Cost Of Constuction reflects August 1991 price levels.

(2) Interest During Construction was computed using a three year construction length, a 12 month construction season, monthly compounding and an 8.50 percent annual interest rate.

(2) Interest and amortization was computed using a 50 year project life and an 8.50 percent annual interest rate.

These investment costs were then converted to average annual equivalent costs based on an annual interest rate of 8.50 percent, and a 50 year project life.

b. Average Annual Maintenance Costs

Annual CDF maintenance costs for Site 10B were added to Average Annual Costs. Benefits attributable to the implementation of Site 10B will not be realized unless shoaled materials are removed from the Federal channels and placed into the structure. Therefore dredging costs required to remove shoal material from the channels need to be accounted for if transportation benefits are to be claimed.

Annual channel dredging costs were assumed to continue under "with project" conditions from project year 1 to project year 15. No dredging costs were assigned to project years 16 through 50. The time stream of annual dredging costs was converted to an average annual basis using a 50 year project life and an 8.50 percent annual interest rate.

c. Total Average Annual Costs

Total Average Annual Costs are the sum of the amortized construction costs and average annual maintenance costs. Total average annual costs for site 10B are $ 4,411,800(Table B 27). These average annual costs are based upon August 1991 price levels, an 8.50 percent annual interest rate, and a 50 year project life.

B5. BENEFIT COST SUMMARY

a. Benefit Cost Summary

Table B28 presents average annual benefits, average annual costs, and net benefits for site 10B. This site has average

Table B28-Summary Of Benefits And Costs- Site 10 B.

Average Annual Benefits (1)	$7,896,500
Average Annual Costs (1)	$4,411,800
Net Benefits	3,484,700
Benefit To Cost Ratio	1.78

(1) Average Annual Benefits and Average Annual Costs were computed based upon an 8.5 percent annual interest rate, a 50 year project life and August 1991 price levels.

annual benefits of $ 7,896,500, average annual costs of $ 4,411,800, net benefits of $ 3,484,700 and a benefit to cost ratio of 1.8.

APPENDIX C

U.S. FISH AND WILDLIFE SERVICE - COORDINATION ACT REPORT

United States Department of the Interior
Fish and Wildlife Service
Reynoldsburg Field Office
6950-H Americana Parkway
Reynoldsburg, Ohio 43068-4115

TAKE PRIDE IN AMERICA

5 APR 93 09 15

In Reply Refer to:

COMM: 614/469-6923 FAX: 614/469-6919
March 31, 1993

Colonel John W. Morris
District Engineer
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Attention: Len Bryniarski

Dear Colonel Morris:

This is our Final Fish and Wildlife Coordination Act Report on a proposed confined disposal facility (CDF) Site 10B at Cleveland, Cuyahoga County, Ohio. The report has been prepared under authority of the Fish and Wildlife Coordination Act (48 stat. 401, as amended 16 U.S.C. 661 et seq.), for the Buffalo District Corps of Engineers per agreement No. NCB-1A-92-OBEG, dated December 12, 1991.

This report has been reviewed by the Ohio Division of Wildlife. Their concurrance letter dated March 23, 1993, is attached.

The Cleveland Harbor area, protected by breakwaters, is five miles long and 1,600 to 2,400 feet wide for a total area of approximately 1,300 acres. Improved and dredged channels are maintained in the lower 5.8 miles of the Cuyahoga River, the Old River Channel, and the Outer Harbor. The Lake Approach Channel is maintained at a depth of 29 feet. The Outer Harbor is 28 feet deep up to the mouth of the Cuyahoga River. The Lower Cuyahoga River Channel is 27 feet deep up to the junction of Old River and 23 feet deep upstream to mile 5.8. In general, water quality has been improving over the last 15 years; but most of the sediments are still highly to moderately polluted and unsuitable for open lake disposal.

The proposed CDF (Site 10B) will be attached to a former disposal facility on the east and existing Burke Airport fill on the south (see Plate 1). A rubblemound dike will be constructed on the north side (4,500 feet) and west side (550 feet) to encompass an area of approximately 68 acres. The dike wall will be constructed with various sizes of rock ranging from that passing through a #200 sieve to 2.5 ton. A clay closure wall, approximately 5 feet high, will be constructed along the adjacent length of Burke Lakefront Airport. This wall will be removed when the CDF is full and the fill has

consolidated. The water depths in the area of the proposed CDF vary from about 18 feet to 25 feet.

The navigation channel which will be adjacent to the north dike wall is maintained at a depth of 28 feet. Sediments in the proposed disposal area are probably fine sands, clay, gravel and some organic material. This assumption is based on sediments we found at the proposed CDF site (Burke East) just to the east of existing filled disposal facility (Dike 12).

FISH AND WILDLIFE RESOURCES

Aquatic resources of Cleveland Harbor are many and varied. Species composition has changed over the years towards more pollution tolerant species due to the overall reduction in water quality. However in recent years, this trend may have stabilized or improved slightly from conditions in the mid 1970's.

Approximately 50 species of benthic microinvertebrates (primarily oligochaetes) have been reported in the Cleveland nearshore zone (Pliodzinskas, 1978). We have not conducted any benthic studies at the proposed site. However, we collected sediment samples at the proposed east basin CDF (Burke East) site in 1988 and the results of that study were provided to the Buffalo District Corps of Engineers in our Biological Report dated May 26, 1989. The location of the sampling sites is indicated on Plate 2 while the results of that benthic study are provided in Table 1. More details are contained in the Biological Report. We believe that many of these organisms would also be found at Site 10B. Also in 1986, the Buffalo District Corps of Engineers contracted a study of sediments and macroinvertebrates at Edgewater Park and Burke Lakefront Airport. The contractor was Aqua Tech Environmental Consultants Incorporated and their report "The Analysis of Sediments from Cleveland Harbor", technical Report #G0176-11, was provided in August, 1986. Table III from that report and the location of the Burke Lakefront sampling sites is attached as Appendix 1.

Fish species in and adjacent to Cleveland Harbor consist of numerous forage and game species. The forage base is dominated by shad, spottail shiner and emerald shiner. Sport fish include white bass, yellow perch, walleye, rock bass and catfish. In recent years, the number of white perch in Cleveland, as well as Lake Erie, has greatly increased to a point where they may be one of the most abundant species.

In the early 1970's Dr. Andrew White conducted various surveys in the Cleveland area (White et.al.). Table 2 lists those species collected as fry or young-of-year in Cleveland Harbor during the years 1972-74. Table 3 provides a list of fish species collected in Cleveland Harbor and adjacent marinas from 1972 to 1974.

In 1986 we set two variable mesh gill nets adjacent to Burke Lakefront Airport at the proposed "Site 10" CDF, which is the same location as the currently proposed Site 10B. The results of that survey are presented in Table 4. Also in 1988 and 1989, we conducted gill net surveys at the Burke East proposed CDF. The results of those surveys are also presented in Table 4. We present this data because we believe that fish populations at Site 10B would be comparable to those found at Site 10 in 1986 and at Burke East in 1988 and

1989. White et.al. collected a total of 47 species in Cleveland Harbor and adjacent marinas. Our surveys at Burke East and Site 10 found only about half as many species. Part of the difference can be attributed to the fact that we only used gill nets while White used a variety of sampling methods.

Vegetation in the project area of Site 10B is limited. There are a few small trees along the edge of Burke Lakefront Airport, but most of the area contains grasses and herbs. There is also some algae attached to the riprap along Burke Lakefront Airport. Wildlife resources in the project area consists primarily of avian species. In April 1989 we observed the following birds: Bonaparte's, herring and ring-billed gulls, common merganser, scaup, mallards, bufflehead, woodduck and common tern. On the edge of the filled CDF, we observed Canada geese, common flicker, American robin, red-winged blackbird and great blue heron. In May 1989 we also observed black crowned night herons, barn swallows, and chimney swifts. We have made no surveys in the area for upland species, although we expect to find small mammals, and reptiles and probably pheasants and rabbits on the Burke Lakefront Airport property.

ENDANGERED SPECIES COMMENTS: The proposed project lies within the range of the Indiana bat and piping plover, Federally listed endangered species. Due to type of habitat in the project area, the project, as proposed, will have no impact on these species. This precludes the need for further action on this project as required by the 1973 Endangered Species Act, as amended. Should the project be modified or new information become available that indicates listed or proposed species may be affected, consultation should be initiated.

DISCUSSION AND RECOMMENDATIONS

We have been discussing, commenting, and preparing reports on various proposed CDF's in the Cleveland area since the currently used CDF (Dike 14) was constructed. The Corps has borrowed some time for the need for a new CDF by raising the dike walls of Dike 14. By raising these dike walls, Dike 14 will be capable of holding an additional 3-5 years of dredged material. This is the second time we have looked at a proposed CDF at Burke Lakefront Airport. The first proposal was known as Site 10. We prepared an April 23, 1987 Draft Fish and Wildlife Coordination Act Report on this and other proposed sites in the Cleveland Harbor area.

Over the years, we have requested that the Corps consider using upland disposal sites for dredged material. We have also recommended use of dredged material as fill for industrial, transportation or commercial projects in the Cleveland area. For the last few years, some of the material dredged from the uppermost portion of the navigation channel has been clean enough to use as beach nourishment or introduced into the littoral drift.

In our opinion, the most economical and environmentally sound solution to maintenance dredging and disposal of dredged material is to keep the sediments out of the Cuyahoga River navigation channel. To this end, we are willing to assist the corps or any other Federal, state or local agency in upland erosion control programs or projects.

In our opinion, the implementation of an upland and floodplain erosion control program are the type of long range planning which should be implemented. By implementation of such a program, the need for costly, habitat destroying inwater CDF's could be eliminated or greatly reduced in the future. By investing some time and money now, the government could eliminate or reduce the maintenance dredging cost in future years. Along with stricter pollution control standards, the sediments which would remain and need to be dredged could be classified as non-polluted or moderately polluted and open lake disposal would be appropriate. If action is not taken in the near future, the cost of controlling the erosion and confining the polluted sediments will only increase. Also, if the source of erosion is not controlled, at least partially, the immediate problem of removing sediments is perpetuated.

The construction of the proposed CDF in Cleveland Harbor would require mitigation for the loss of 68 acres of deep water aquatic habitat. Replacement of the loss of deepwater habitat with in-kind mitigation would not be practical. Therefore, we recommend out-of-kind mitigation measures to enhance spawning habitat in Cleveland Harbor be initiated. One spawning habitat technique would consist of designing into the proposed CDF dike a spawning shelf. This shelf constructed on the waterward side of the dike should be 4+/- feet wide and be located about 4-8 feet below normal water level. Preferably, portions of the shelf would be constructed at 4-6 and 6-8 feet to allow various species spawning sites at various water levels. We envision the shelf being constructed of larger stone and then capped with a layer of gravel. The gravel may have to be replenished, if ice conditions or wave action moves the gravel. Another mitigation measure to consider would be to locate shallow water areas in or near Cleveland Harbor that could be developed into spawning areas with the addition of gravel substrate. In both cases, the mitigation spawning areas would need to be maintained for the life of the project.

We appreciate this opportunity to provide this report and look forward to additional discussion and planning meetings regarding the proposed mitigation measures discussed above.

Sincerely,

Kent E. Kroonemeyer

Kent E. Kroonemeyer
Supervisor

cc: DOW, Wildlife Environmental Section, Columbus, OH
ODNR, Office of Realty and Land Management, Columbus, OH
Ohio EPA, Water Quality Monitoring, Attn: G.Hesse, Columbus, OH
US EPA, Office of Environmental Review, Chicago, IL

Aqua Tech Environmental Consultants, Inc. "The Analysis of Sediments from Cleveland Harbor," Cleveland, Ohio. Contract #DACW49-86-D001 Del. 0013. Technical Report #G0176-11, August, 1986.

Pliodzinskas, A.J., 1979. "A General Overview of Lake Erie's Nearshore Benthic Macroinvertebrates." Center for Lake Erie Area Research: Ohio State University, Columbus, Ohio. Report 126. 83 pp.

U.S. Army Corps of Engineers (Buffalo District). Cuyahoga River, Ohio Restoration Study, Executive Summary, August, 1986.

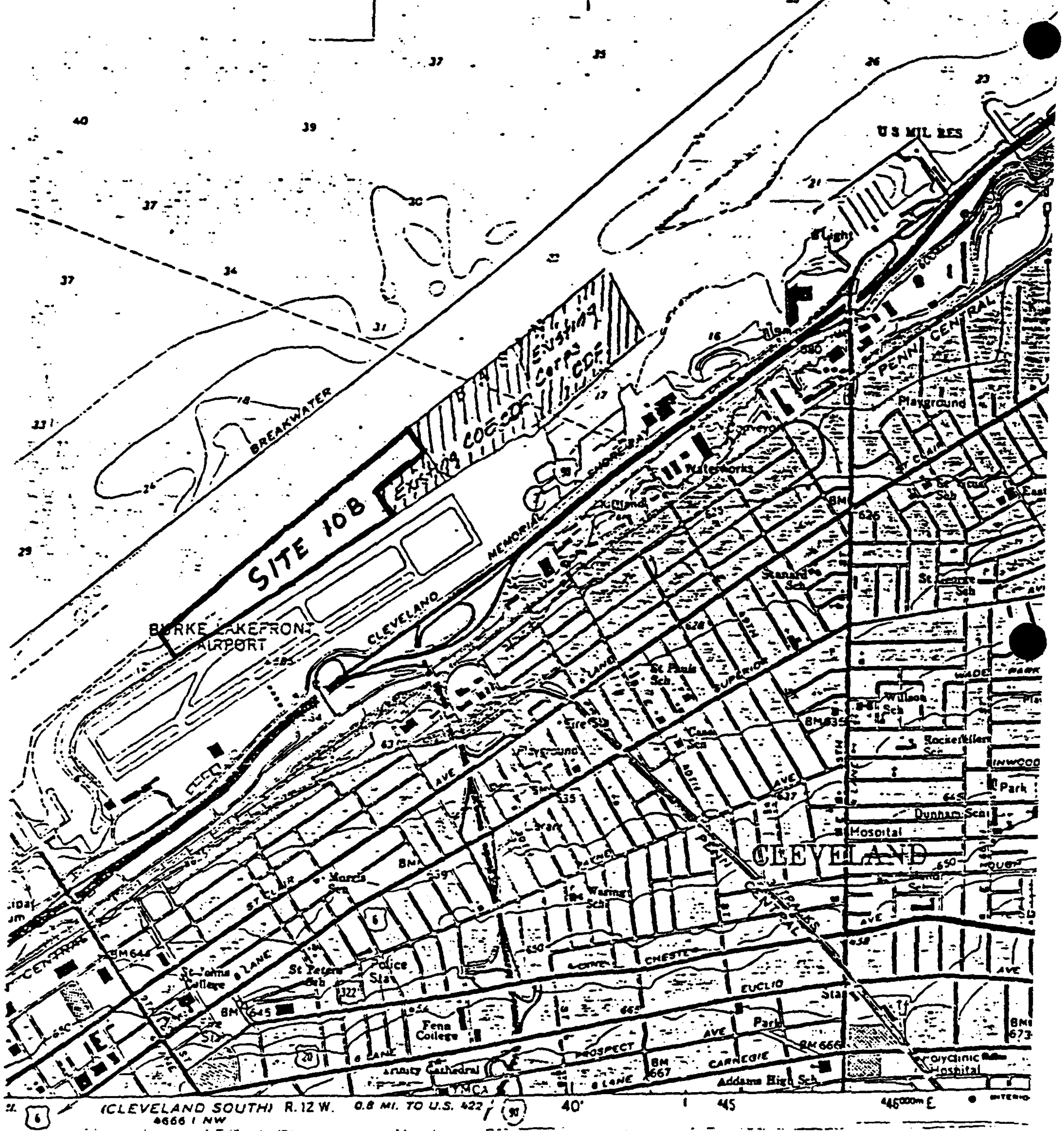
U.S. Fish and Wildlife Service, July 23, 1986. "Planning Aid Letter on Selection of a Confined Disposal Facility at Cleveland, Cuyahoga County, Ohio," Columbus, Ohio.

U. S. Fish and Wildlife Service (Ecological Service Field Office). "Biological Report on East Basin Confined Disposal Facility," Cleveland Harbor, Cuyahoga County, Ohio. May 26, 1989, Reynoldsburg, Ohio.

White, A.M., M.B. Troutman, E.J. Foell, M.P. Kelty, and R. Geby. 1975. "Water Quality Baseline Assessment for the Cleveland Area." Lake Erie, Vol. 11-Fishery. U. S. Environmental Protection Agency: Region V. Chicago, Illinois. Report EPA-905/9-75-001. 181 pp.

SW/4 EUCLID 15' QUADRANGLE
N4130—W8137.5/7.5

1963
PHOTOREVISED 1970
AMS 4667 II SW—SERIES V852

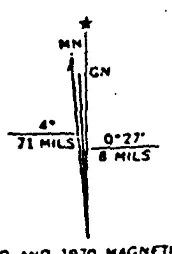


SCALE 1:24 000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

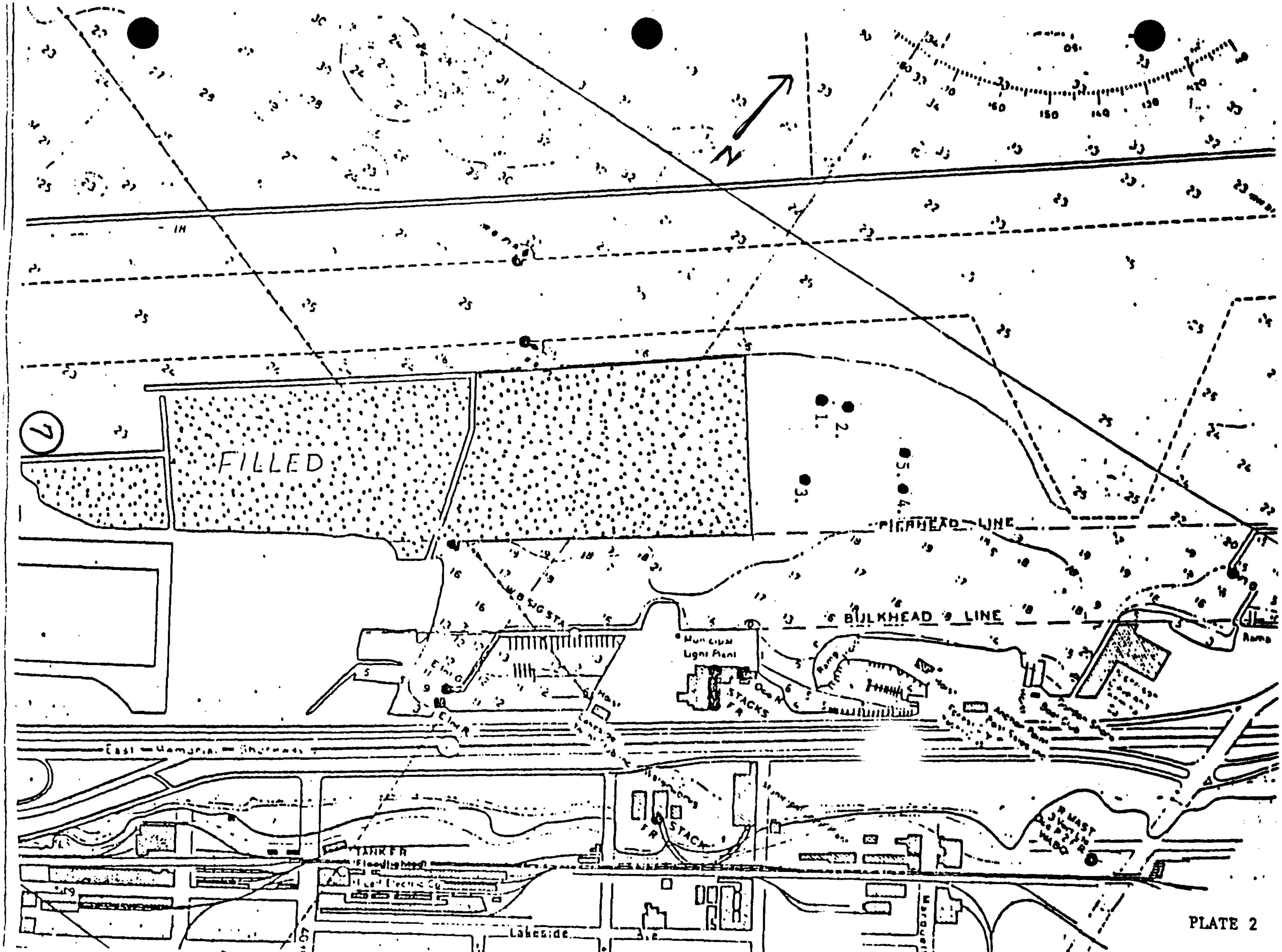
1 .5 0 1 KILOMETER



UTM GRID AND 1970 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 5 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS LOW WATER 570.5 FEET

PLATE 1



N
PIERHEAD LINE
BULKHEAD LINE
FILLED
1.
2.
3.
4.
5.
Municipal Light Plant
STACKS
STACK
TANKER
Lakeside
Marquette
East Hampton Highway

PLATE 2

TABLE 1. AVERAGE NUMBER OF ORGANISMS PER SAMPLE, BY STATION

	STATION 1	STATION 2	STATION 3	STATION 4	STATION 5
INSECTA					
CHIRONOMIDAE					
Procladius Sp.	2.33	3.67	5.67	10.67	15
Chironomus Sp.			0.67	1.33	4.66
CRUSTACEA					
GAMMARIDAE					
Gammarus Sp.					0.33
MOLLUSCA					
SPHAERIIDAE	7	8.3	11.33	22.33	22.33
ANNELIDA					
HIRUDINEA		0.33			0.67
ANNELIDA					
NAIDIDAE					
Arcteonais lomondi	0.33				0.5
Dero sp.			1.67		
Dero nivea	7.67	5.67		6.67	19
Nais simplex				1	
Nais sp.				3	
Pristina sp.				1	
Pristina osborni	6.33	17	6.33	11.67	2
Pristina sima	3.33	1.33			6.5
Specaria josinea	1.67	9	3	0.67	
TUBIFICIDAE					
Aulodrilus limnobius	1	0.33	1.33	2.67	8
Aulodrilus pigueti	10	10	1.66	10.33	12.5
Aulodrilus pluriseta	0.33		6.33	0.67	0.5
Limnodrilus cervix	2.67	8.67	3.67	13	10.5
Limnodrilus claparedianus		0.33			
Limnodrilus hoffmeisteri	3.66	1.33	2	10.67	6.5
Limnodrilus maumeensis		1.33	4.33	0.33	1
Limnodrilus udekemianus	1				
Peloscolex sp.	1				
Potamothrix vejdovskyi	2.33	3.67	5	12	5
Quistadrilus multisetosus	1.33				
immat. w/ hair setae			1		
immat. w/o hair setae	91.3	122	74.67	64.67	57
TOTAL ORGANISMS	143.29	192.96	129.66	172.68	171.99
TOTAL OLIGOCHAETES	133.95	180.66	110.99	138.35	129
OLIGOCHAETES / SQ. METER	5768	7779	4779	5957	5555

Table 2. Species of Fishes Collected as Fry or Young-of-the-Year in Cleveland Harbor, 1972-1974*

Species	Abundance**
Alewife	Abundant
Gizzard shad	Abundant
Rainbow smelt	Abundant
Quillback	Rare
White sucker	Uncommon
Common carp	Common
Goldfish	Common
Golden shiner	Abundant
Longnose dace	Rare
Emerald shiner	Abundant
Spottail shiner	Uncommon
Fathead minnow	Rare
Bluntnose minnow	Common
Trout-perch	Rare
Brook silverside	Rare
White bass	Uncommon
Rock bass	Uncommon
Largemouth bass	Rare
Green sunfish	Uncommon
Bluegill	Common
Pumpkinseed	Abundant
Yellow perch	Common
Logperch	Rare
White crappie	Uncommon

* from White et al. 1975

** Abundance of each species depicted as a relative term

Table 3. Relative Abundance of Fishes Collected in the Cleveland Harbor and Adjacent Marinas (Revised July 1974)*

Species	No. Collected	% of Total
Longnose gar	1	0.01 %
Alewife	92	0.85
Gizzard shad	2,525	23.43
Chinnok salmon	9	0.08
Coho salmon	42	0.39
Rainbow trout	2	0.02
Rainbow smelt	323	3.00
Northern pike	15	0.14
Common carp	64	0.59
Goldfish	97	0.90
Golden shiner	393	3.65
Longnose dace	1	0.01
Creek chub	1	0.01
Blacknose dace	1	0.01
Emerald shiner	4,092	37.97
Striped shiner	1	0.01
Spottail shiner	903	8.38
Spotfin shiner	6	0.06
Sand shiner	33	0.31
Mimic shiner	6	0.06
Fathead minnow	1	0.01
Bluntnose minnow	74	0.69
Stoneroller	2	0.02
Quillback	1	0.01
Black redhorse	1	0.01

Table 3. (continued) Relative Abundance of Fishes Collected in the Cleveland Harbor and Adjacent Marinas (Revised July 1974)*

Species	No. Collected	% of Total
Golden redhorse	2	0.02
Shorthead redhorse	1	0.01
White sucker	89	0.83
Channel catfish	2	0.02
Brown bullhead	23	0.21
Black bullhead	14	0.13
Stonecat	13	0.12
Trout-perch	153	1.42
Brook silverside	3	0.03
White bass	223	2.07
White crappie	80	0.74
Black crappie	11	0.10
Rock bass	5	0.05
Largemouth bass	3	0.03
Warmouth	1	0.01
Green sunfish	3	0.03
Bluegill	4	0.04
Pumpkinseed	34	0.32
Walleye	2	0.02
Yellow perch	1,254	11.64
Logperch	1	0.01
Freshwater drum	170	1.58
TOTALS	10,777	100.05 %
47 species		

* from White, et al., 1975

Table 4. Species and number of fish collected by gill net surveys for the Burke Lakefront (May and Sept 1986) and Burke East (Oct and Nov 1988, Apr and May 1989) proposed Confined Disposal Facilities at Cleveland Harbor, Cuyahoga County, Ohio.*

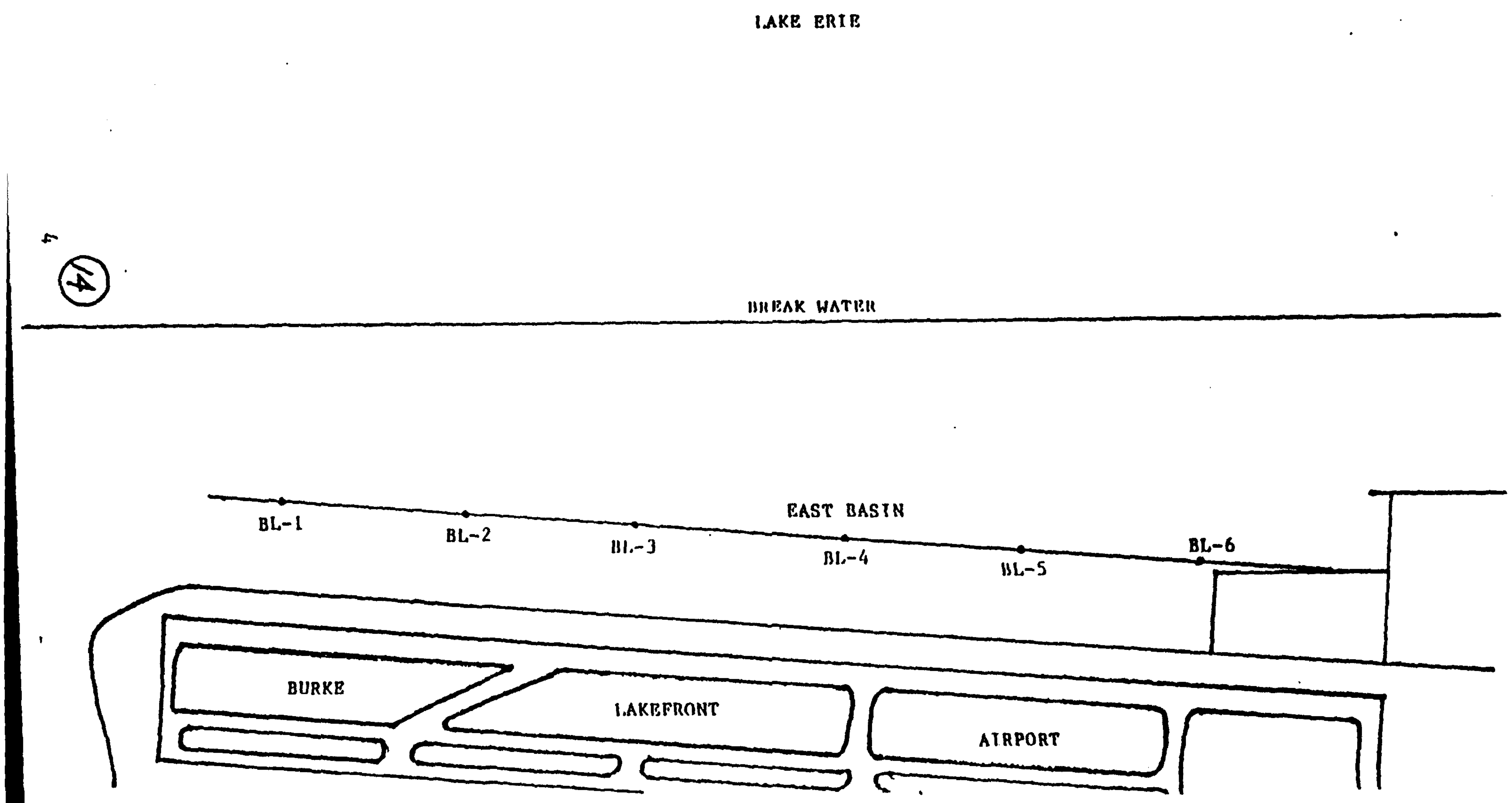
	1986		1988		1989	
	May	Sept	Oct	Nov	Apr	May
Gizzard Shad			58	140	1	11
Black Crappie		1	1	7		
White Crappie				1		
White Perch	88	1	10	3	17	57
Yellow Perch	25		2	6	1	5
White Sucker			3	2	9	15
White Bass			1			1
Largemouth Bass			1	1		1
Smallmouth Bass						1
Rock Bass	2	5	4	4	3	5
Brown Bullhead	1	1	2		1	1
Yellow Bullhead		3				
Channel Catfish		1				
Walleye		8	4			
Northern Pike				1		
Orangespotted sunfish				1		
Tadpole Madtom				1		
Trout-perch					3	
Emerald Shiner					1	
Northern Logperch Darter	2					
Shorthead Redhorse	4	3				
Freshwater Drum	15	1				7
Carp						2
Total	137	24	86	167	36	106

23 Species

* U. S. Fish and Wildlife 1986, 1988, 1989.

APPENDIX 1

Benthos and Sediment data from "The Analysis of Sediments from Cleveland Harbor" Technical Report #G0176-11, August 1986 prepared for the Buffalo District, Army Corps of Engineers by Aquatech Environmental Consultants, Robert Hoke, Principal Biologist.


LAKE ERIE
BREAK WATER
EAST BASIN
BL-1
BL-2
BL-3
BL-4
BL-5
BL-6
BURKE
LAKEFRONT
AIRPORT

(14)

4

Table III. Benthic Macroinvertebrate Abundance and Species Composition from the Cleveland Harbor Area, Cleveland, Ohio - July, 1986

Taxon	Site No. E-3	Site No. E-4	Site No. E-5	Site No. BL-1	Site No. BL-2	Site No. BL-3	Site No. BL-4	Site No. BL-5	Site No. BL-6
Arthropoda									
Insecta									
Chironomidae									
Chironominae									
Chironomini									
Chironomus tentans			1(14)						
Chironomus sp.	4(57)	13(186)	4(57)				2(86)	2(86)	
Tanytarsini									
Constempellina sp.	1(14)		1(14)						
Tanypodinae									
Procladius sp.	10(143)	8(114)	12(172)		1(43)	1(43)	1(43)	2(86)	2(86)
Crustacea									
Malacostraca									
Peracarida									
Amphipoda									
Gammarida									
Gammarus fasciatus		1(14)	2(28)						
Mollusca									
Pelecypoda									
Heterodonta									
Sphaeriidae	28(401)	6(86)	15(215)	52(2236)	86(3698)	38(1634)	18(774)	64(2752)	24(1032)
Annelida									
Clitellata									
Oligochaeta									
Naididae									
Dero sp.			1(14)		1(43)		2(86)		
Nais sp.							4(172)		
Paranais litorius			1(14)						
Pristina longiseta longiseta		1(14)							
Pristina osborni			1(14)						
Specaria josinae			2(28)						
Stylaria lacustris								1(43)	
Chaetogaster sp.			1(14)						
Tubificidae									
Aulodrilus limnobius		1(14)	5(71)	5(215)	10(430)	2(86)		1(43)	
Aulodrilus pigueti									1(43)
Aulodrilus pleuriseta		6(86)	12(172)		3(129)	1(43)	3(129)		10(430)
Limnodrilus cervix	1(14)		2(28)	116(4988)	61(2623)	25(1075)	59(2537)	26(1118)	39(1677)
Limnodrilus cervix-claparedianus intergrade				1(43)					
Limnodrilus hoffmeisteri	7(100)	6(86)	7(100)	40(1720)	42(1806)	21(903)	35(1505)	49(2107)	39(1677)
Limnodrilus maumeensis	2(28)	1(14)							
Peloscolex multisetosus longidentus				2(86)	3(129)	1(43)	5(215)	1(43)	1(43)
Peloscolex m. multisetosus				1(43)				1(43)	
Potamothrix moldeviensis	7(100)	8(114)	7(100)						
Potamothrix vejdovskyi	14(200)	13(186)	16(229)	2(86)		1(43)			
immat. w/ hair setae	2(28)				1(43)		4(172)	1(43)	4(172)
immat. w/o hair setae	24(344)	38(545)	45(645)	110(4730)	58(2494)	45(1935)	64(2752)	59(2537)	37(1591)
Total No. of Organisms	100(1429)	102(1459)	135(1943)	329(14147)	266(11438)	135(5805)	197(8471)	207(8901)	157(6751)
Total No. of Taxa	9	11	17	8	8	8	9	9	7
Shannon Diversity (H')	0.769	0.909	1.039	0.525	0.594	0.583	0.64	0.559	0.617

Numbers enclosed in perenthesis indicate number of organisms per meter squared as extrapolated from the actual number of organisms collected, number of samples and area of samples.

OHIO
Department of Natural Resources

RECEIVED
MAR 29 1993
U.S. Fish & Wildlife Service
Reynoldsburg, Ohio

ROUTING STAMP
KROONEMEYER
MULTERER
KUREY
HEGGE
LAMMERS
FAZIO
BAKER
ALL STAFF
FILE
RETURN TO

George V. Voinovich • Governor
Frances S. Buchholzer • Director

Division of Wildlife
1840 Belcher Drive
Columbus, OH 43224
614/265-6300
FAX 614/262-1143

March 23, 1993

Mr. Kent E. Kroonemeyer
U.S. Fish & Wildlife Service
Reynoldsburg Field Office
6950-H Americana Parkway
Reynoldsburg, Ohio 43068-4115

Dear Mr. Kroonemeyer:

The final Fish and Wildlife Coordination Act report for the proposed confined disposal facility (CDF) Site 10B at Cleveland Harbor has been reviewed and the Division of Wildlife (DOW) concurs with the report.

The DOW would also like to reemphasize two concerns raised in the final report. The first concern regards the upland disposal of dredged material versus construction of confined disposal sites. The utilization of the various upland disposal methods as referenced in the report would be highly favored over the loss and/or alteration of shore line and deep water habitat. Second, is the need to shift more attention to the source of the dredging disposal problem, i.e. upland erosion. The maintenance dredging of navigational channels and the disposal of the resulting dredge material is merely treating the symptoms of the real problem.

There is one additional concern the DOW has with the proposed CDF. Page 57, Item 4.17 of the Draft EIS states that efforts would be made, if possible, to live trap fish that are caught within the CDF once the dike is completed. The DOW believes, from past experience, that the cost to live trap far exceeds the value of the fish involved and would only remove a very small proportion of the fish actually caught within the enclosure. The loss of said fish would have an extremely marginal effect on the fishery of Lake Erie. Based on these factors the DOW recommends that a meeting be held to estimate the number of fish to be caught in the enclosure and derive a compensatory figure to be paid in lieu of the proposed trapping. The DOW believes that this would be a much more practical, economical, and efficient solution to the problem.

The DOW appreciates the opportunity to review and comment on the final report.

Sincerely,

Richard B. Pierce
Chief

United States Department of the Interior
Fish and Wildlife Service
Reynoldsburg Field Office
6950-H Americana Parkway
Reynoldsburg, Ohio 43068-4115

TAKE PRIDE IN AMERICA

5 Apr 93 09 15

In Reply Refer to:

COMM: 614/469-6923 FAX: 614/469-6919
March 31, 1993

Colonel John W. Morris
District Engineer
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Attention: Len Bryniarski

Dear Colonel Morris:

This is our Final Fish and Wildlife Coordination Act Report on a proposed confined disposal facility (CDF) Site 10B at Cleveland, Cuyahoga County, Ohio. The report has been prepared under authority of the Fish and Wildlife Coordination Act (48 stat. 401, as amended 16 U.S.C. 661 et seq.), for the Buffalo District Corps of Engineers per agreement No. NCB-1A-92-OBEG, dated December 12, 1991.

This report has been reviewed by the Ohio Division of Wildlife. Their concurrence letter dated March 23, 1993, is attached.

(18)

1

The Cleveland Harbor area, protected by breakwaters, is five miles long and 1,600 to 2,400 feet wide for a total area of approximately 1,300 acres. Improved and dredged channels are maintained in the lower 5.8 miles of the Cuyahoga River, the Old River Channel, and the Outer Harbor. The Lake Approach Channel is maintained at a depth of 29 feet. The Outer Harbor is 28 feet deep up to the mouth of the Cuyahoga River. The Lower Cuyahoga River Channel is 27 feet deep up to the junction of Old River and 23 feet deep upstream to mile 5.8. In general, water quality has been improving over the last 15 years; but most of the sediments are still highly to moderately polluted and unsuitable for open lake disposal.

The proposed CDF (Site 10B) will be attached to a former disposal facility on the east and existing Burke Airport fill on the south (see Plate 1). A rubblemound dike will be constructed on the north side (4,500 feet) and west side (550 feet) to encompass an area of approximately 68 acres. The dike wall will be constructed with various sizes of rock ranging from that passing through a #200 sieve to 2.5 ton. A clay closure wall, approximately 5 feet high, will be constructed along the adjacent length of Burke Lakefront Airport. This wall will be removed when the CDF is full and the fill has

---

U.S. Department of the Interior
Fish and Wildlife Service

Letter Dated:
March 31, 1993

1. <u>GENERAL</u> - Thank you for your coordination, review, and comments. The numbered response paragraphs correspond to your numbered discussion and recommendation paragraphs.

consolidated. The water depths in the area of the proposed CDF vary from about 18 feet to 25 feet.

1 The navigation channel which will be adjacent to the north dike wall is maintained at a depth of 28 feet. Sediments in the proposed disposal area are probably fine sands, clay, gravel and some organic material. This assumption is based on sediments we found at the proposed CDF site (Burke East) just to the east of existing filled disposal facility (Dike 12).

FISH AND WILDLIFE RESOURCES

Aquatic resources of Cleveland Harbor are many and varied. Species composition has changed over the years towards more pollution tolerant species due to the overall reduction in water quality. However in recent years, this trend may have stabilized or improved slightly from conditions in the mid 1970's.

Approximately 50 species of benthic microinvertebrates (primarily oligochaetes) have been reported in the Cleveland nearshore zone (Pliodzinskas, 1978). We have not conducted any benthic studies at the proposed site. However, we collected sediment samples at the proposed east basin CDF (Burke East) site in 1988 and the results of that study were provided to the Buffalo District Corps of Engineers in our Biological Report dated May 26, 1989. The location of the sampling sites is indicated on Plate 2 while the results of that benthic study are provided in Table 1. More details are contained in the Biological Report. We believe that many of these organisms would also be found at Site 10B. Also in 1986, the Buffalo District Corps of Engineers contracted a study of sediments and macroinvertebrates at Edgewater Park and Burke Lakefront Airport. The contractor was Aqua Tech Environmental Consultants Incorporated and their report "The Analysis of Sediments from Cleveland Harbor", technical Report #G0176-11, was provided in
2 August, 1986. Table III from that report and the location of the Burke Lakefront sampling sites is attached as Appendix 1.

Fish species in and adjacent to Cleveland Harbor consist of numerous forage and game species. The forage base is dominated by shad, spottail shiner and emerald shiner. Sport fish include white bass, yellow perch, walleye, rock bass and catfish. In recent years, the number of white perch in Cleveland, as well as Lake Erie, has greatly increased to a point where they may be one of the most abundant species.

In the early 1970's Dr. Andrew White conducted various surveys in the Cleveland area (White et.al.). Table 2 lists those species collected as fry or young-of-year in Cleveland Harbor during the years 1972-74. Table 3 provides a list of fish species collected in Cleveland Harbor and adjacent marinas from 1972 to 1974.

In 1986 we set two variable mesh gill nets adjacent to Burke Lakefront Airport at the proposed "Site 10" CDF, which is the same location as the currently proposed Site 10B. The results of that survey are presented in Table 4. Also in 1988 and 1989, we conducted gill net surveys at the Burke East proposed CDF. The results of those surveys are also presented in Table 4. We present this data because we believe that fish populations at Site 10B would be comparable to those found at Site 10 in 1986 and at Burke East in 1988 and

2. FISH AND WILDLIFE RESOURCES - No further response necessary here.

1989. White et.al. collected a total of 47 species in Cleveland Harbor and adjacent marinas. Our surveys at Burke East and Site 10 found only about half as many species. Part of the difference can be attributed to the fact that we only used gill nets while White used a variety of sampling methods.

2 Vegetation in the project area of Site 10B is limited. There are a few small trees along the edge of Burke Lakefront Airport, but most of the area contains grasses and herbs. There is also some algae attached to the riprap along Burke Lakefront Airport. Wildlife resources in the project area consists primarily of avian species. In April 1989 we observed the following birds: Bonaparte's, herring and ring-billed gulls, common merganser, scaup, mallards, bufflehead, woodduck and common tern. On the edge of the filled CDF, we observed Canada geese, common flicker, American robin, red-winged blackbird and great blue heron. In May 1989 we also observed black crowned night herons, barn swallows, and chimney swifts. We have made no surveys in the area for upland species, although we expect to find small mammals, and reptiles and probably pheasants and rabbits on the Burke Lakefront Airport property.

ENDANGERED SPECIES COMMENTS: The proposed project lies within the range of the Indiana bat and piping plover, Federally listed endangered species. Due to type of habitat in the project area, the project, as proposed, will have no impact on these species. This precludes the need for further action on this project as required by the 1973 Endangered Species Act, as amended. Should the project be modified or new information become available that indicates listed or proposed species may be affected, consultation should be initiated.

<u>DISCUSSION AND RECOMMENDATIONS</u>

3 We have been discussing, commenting, and preparing reports on various proposed CDF's in the Cleveland area since the currently used CDF (Dike 14) was constructed. The Corps has borrowed some time for the need for a new CDF by raising the dike walls of Dike 14. By raising these dike walls, Dike 14 will be capable of holding an additional 3-5 years of dredged material. This is the second time we have looked at a proposed CDF at Burke Lakefront Airport. The first proposal was known as Site 10. We prepared an April 23, 1987 Draft Fish and Wildlife Coordination Act Report on this and other proposed sites in the Cleveland Harbor area.

Over the years, we have requested that the Corps consider using upland disposal sites for dredged material. We have also recommended use of dredged material as fill for industrial, transportation or commercial projects in the Cleveland area. For the last few years, some of the material dredged from the uppermost portion of the navigation channel has been clean enough to use as beach nourishment or introduced into the littoral drift.

4 In our opinion, the most economical and environmentally sound solution to maintenance dredging and disposal of dredged material is to keep the sediments out of the Cuyahoga River navigation channel. To this end, we are willing to assist the corps or any other Federal, state or local agency in upland erosion control programs or projects.

20

<u>DISCUSSION AND RECOMMENDATION</u>

3. Upland confined disposal facilities and/or alternate use measures are discussed in EIS paragraphs 2.14 through 2.18.

The Corps has given consideration to upland areas as disposal sites. There are numerous problems with upland sites. First, the local sponsor is required to provide the disposal site and due to the heavy industrial and commercial use of the land areas adjacent to the Federal navigation channel there simply is no suitable available nearby site. Second, more distant sites would probably have to be outside the Cleveland harbor or city area because of the high degree of urbanization. Even if such a site were available, it's unlikely that other communities would be willing to have the dredged polluted spoil "dumped" in their backyard as they derive little, if any, direct benefit from the harbor. Third, the transport of large quantities of saturated dredged material would pose considerable problems and, in itself, may have considerable impacts. Fourth, the potential use of an upland site generates an array of engineering, economic, environmental, and social concerns equal to or greater than potential use of a shoreline open-water CDF site.

The Corps has and will continue to beneficially use the clean, sandy fraction of the Cuyahoga River sediments as nourishment for Bratenahl Beach by placement in the nearshore littoral zone. An item of note is that the Buffalo District is one of several entities engaged in developing a Long Term Management Strategy (LTMS) Action Plan for Toledo Harbor, Ohio. This study may serve as a pilot study to further advance consideration and feasibility of alternative measures.

4. Pollution control and upstream erosion control measures are discussed in EIS paragraphs 2.06 and 2.07 through 2.12.

4 In our opinion, the implementation of an upland and floodplain erosion control program are the type of long range planning which should be implemented. By implementation of such a program, the need for costly, habitat destroying inwater CDP's could be eliminated or greatly reduced in the future. By investing some time and money now, the government could eliminate or reduce the maintenance dredging cost in future years. Along with stricter pollution control standards, the sediments which would remain and need to be dredged could be classified as non-polluted or moderately polluted and open lake disposal would be appropriate. If action is not taken in the near future, the cost of controlling the erosion and confining the polluted sediments will only increase. Also, if the source of erosion is not controlled, at least partially, the immediate problem of removing sediments is perpetuated

5 The construction of the proposed CDF in Cleveland Harbor would require mitigation for the loss of 68 acres of deep water aquatic habitat. Replacement of the loss of deepwater habitat with in-kind mitigation would not be practical. Therefore, we recommend out-of-kind mitigation measures to enhance spawning habitat in Cleveland Harbor be initiated. One spawning habitat technique would consist of designing into the proposed CDF dike a spawning shelf. This shelf constructed on the waterward side of the dike should be 4+/- feet wide and be located about 4-8 feet below normal water level. Preferably, portions of the shelf would be constructed at 4-6 and 6-8 feet to allow various species spawning sites at various water levels. We envision the shelf being constructed of larger stone and then capped with a layer of gravel. The gravel may have to be replenished, if ice conditions or wave action moves the gravel. Another mitigation measure to consider would be to locate shallow water areas in or near Cleveland Harbor that could be developed into spawning areas with the addition of gravel substrate. In both cases, the mitigation spawning areas would need to be maintained for the life of the project.

We appreciate this opportunity to provide this report and look forward to additional discussion and planning meetings regarding the proposed mitigation measures discussed above.

Sincerely,

Kent E. Kroonemeyer

Kent E. Kroonemeyer
Supervisor

cc: DOW, Wildlife Environmental Section, Columbus, OH
ODNR, Office of Realty and Land Management, Columbus, OH
Ohio EPA, Water Quality Monitoring, Attn: G.Hesse, Columbus, OH
US EPA, Office of Environmental Review, Chicago, IL

21

While we agree that the ideal situation would be to eliminate/limit the amount of sediment entering the channel, the Corps has specific, limited authorities which do not include any sediment management activities. The Buffalo District did look at reducing the sediment load of the river under the authority of and as part of the Cuyahoga River Restoration Study conducted in the 1970's and 1980's. The recommendations in the report were for local interests to: implement Best Management Practices (BMP's) to reduce sheet and rill erosion in critically eroding areas, based on U.S. Soil Conservation Service experience with similar projects; and implement BMP's for non-point sediment sources. Many study recommendations have/been or are being implemented to some degree. The study estimated that the two BMP actions could reduce the volume of sediment entering the harbor by approximately 50 percent. Some progress in this regard may be evident over the last few decades via erosion reduction programs, land use change, or probably both. Over the last few decades, the amount of material dredged from Cleveland Harbor has been reduced from about 500,000 cubic yards to 300,000 cubic yards on an average annual basis.

The two suggestions made are valid ones that could be implemented by other local, State, and Federal agencies, as the Corps has no authority to work on upland and non-point erosion control or pollution control. An item of note is that the Buffalo District is one of several entities engaged in developing a Long Term Management Strategy (LTMS) Action Plan for Toledo Harbor, Ohio. In the development of this strategic plan watershed sediment management will be reviewed along with other alternatives. This Action Plan is scheduled for completion in October 1993 and its recommendations may have future applicability for the Cuyahoga River watershed.

5. Although creation of a "gravel shelf to improve spawning habitat" could improve fisheries habitat, the Buffalo District also recognizes that the submerged stone of the CDF dike would provide an estimated 9 acres of stable long-term fish habitat - some of which would likely be used by fish species as spawning, nursery, and/or feeding habitat. This habitat would probably be of more value to the fishery than the very soft muck bottom (estimated to be about 7 feet deep in thickness) containing silt and clay material at the deep water CDF site. Additionally, the project would facilitate dredging removal and CDF contaminant of sediments dredged from the harbor that are considered to be "not suitable for unrestricted open-lake disposal," restricting movement of such material into the open water and sediments (environments) of the Harbor and Lake.

In light of the overall project mandate, costs, objectives/accomplishments, and assessment evaluation or trade-offs, the Corps of Engineers can not warrant "mitigation" (as it is defined by or as it pertains to the Corps planning criteria) for the project.

Lesser environmental design, consideration, or compensation measures may be considered and may be feasible if: a) they are incidental to the base project, b) they may be implemented at no additional or minor cost, and c) such measures further avoid, minimize, or compensate for lesser adverse impacts or improve environmental conditions.

Unfortunately, a number of serious problems have surfaced pertaining to consideration and implementation of the proposed measures. Considering the previous statements, the predominant problem is that raising the dike berm to the proposed elevation would require significant structural modification and associated costs which are not acceptable. The revised dike cross-section has a berm on both sides for stability reasons. The bottom material is very soft, unconsolidated silt and clay which will be displaced to some extent by dike construction. The underlying material also has a low bearing capacity and the berms are required to provide the factor of safety necessary to prevent any failure. These berms are at -18.0 to -20.0 feet on the lakeward side and

-20.0 feet on the containment side (all referenced to LWD). A four foot wide shelf extending up to -6.0 feet on the lakeward side would require counterbalancing on the containment side which not only adds to the cross-sectional area of the dike and its cost, but also reduces the available space in the CDF for dredged material - requiring us to make the containment area larger - and again more costly. We conservatively estimate the cost of the additional stone to construct the shelf and the counterweight to be hundreds of thousands of dollars. This does not include the placement of gravel on top of the armor stone. The shelf is also likely to require annual replacement of gravel sized stone on the submerged berm due to scouring by wave action which would be costly and would require the local sponsor to assume that responsibility once the CDF site is filled. It is unlikely that the sponsor would agree to such a stipulation. Also, recent comments received by the Corps from the FAA (letter dated March 15, 1993) and the City of Cleveland (letter dated April 15, 1993), indicated strong opposition to the spawning shelf because of their concern that, if the CDF when filled was converted to an airport runway area, *the fisheries improvement measure may contribute* toward further attracting birds to the area that feed on juvenile fish, thereby posing an increased potential safety hazard to pilots and aircraft utilizing the runway.

Placement of gravel in shallow unprotected coastal water areas in the general vicinity of the airport or harbor would probably not be acceptable for similar reasons. Additionally, Corp's mitigation and compensation policy (rule of thumb) directs compensation (as necessary) in kind, in time, and in place. Measures would need to be in proximity to the site. In view of the factors addressed in the above paragraphs, it is the Buffalo District's conclusion that the proposed measures are not feasible for the proposed project.

CLEVELAND HARBOR, CUYAHOGA COUNTY, OHIO

CONFINED DISPOSAL FACILITY PROJECT (SITE 10B - 15 YEAR)

FINAL

ENVIRONMENTAL IMPACT STATEMENT AND APPENDICES

March
1994